REPORT – 1

REVIEW OF BANJAR PANJI-1 INCIDENT PLANNING AND EXECUTION OF DRILLING PROGRAM

1.0 SUMMARY:

This report examines the due diligence conducted by the drilling department in planning the Banjar Panji – 1 (BP-1) well. The report also reviews the procedures and data collection, data interpretation and reconciliation of the real-time information with the planned information. A prudent drilling plan should have built-in flexibility to account for expected as well as un-expected variations to the plan as real-time information becomes available. Appropriate attention was directed to procedures in place for such contingencies.

We found the pre-planning and preparatory work to be in accordance with accepted practice and of a high standard. A significant effort was devoted to integrating the G&G (geology and geophysics) data in planning the BP-1 well. Before drilling BP-1, relevant information, including leak-off tests (LOT), was collected for almost all the drilled wells in the region – a mammoth task. The information from Porong-1 well was, in particular, reviewed thoroughly because the BP-1 well also targeted the same formation.

The G&G department was constantly engaged with the drilling personnel during the drilling of the well and played an active role in analyzing the real-time well logging information. The Drilling Department had built-in procedures to handle any changes to the drilling program by the "Management of Change" procedure. In this approach, the whole team – drilling and G&G – is expected to come together and establish a consensus prior to recommending a change to the pre-planned procedure. This consensual request is then presented to management for approval before it is executed.

The due diligence exercised by Lapindo during the planning stage included:

1. Ensuring the presence of properly experienced personnel in the Drilling Project, including personnel in the service companies.
2. Ensuring quality of the Service Companies with appropriate track records (most of them international companies such as Halliburton, M-I Baker Atlas, Weatherford & El Nusa).
3. The drilling rig used was checked by a well known rig quality inspector (Modu Spec) to ensure that it was ready to drill. Any deficiencies were noted to be repaired by the rig operator before the start of the operations.

To increase the safety of the operations, the drilling department required that all personnel must have the required Migas certification. Lapindo further required and facilitated all drillers and their supervisor to attend a Migas Well Control Refresher course in Cepu in order to refresh their Well Control skill.

Drilling also facilitated the Off-Site HAZOP (Drilling on Paper) where the Rig Company and all the Service Companies personnel discussed with Lapindo

Exploration staffs all potential problems and their mitigation plans. The results of the HAZOP were documented and included as part of the Drilling Program. When it was time to drill, it again was discussed in the Pre Spud meetings that were held both in the office and at the rig site.

An oil-base drilling fluid was planned for and used for drilling the 13 ⅜" casing section through a series of high-porosity sensitive shales. This is normally considered an expensive approach, but was chosen to minimize any borehole stability issues that could interfere with the integrity of the wellbore and impair safety or the progress of the drilling program. The decision paid off as this section of the hole was drilled very smoothly with no borehole instability issues arising. In contrast, Porong-1 well used water-base drilling fluid systems for all of the sections.

The operational aspect of the drilling was conducted using generally accepted industry standards. The safety aspect of drilling was followed by continually checking the kick tolerances which were updated each time a Leak-Off Test (LOT) was done. Standard procedures for minimizing swabbing and surging effects during connections and trips were followed.

The setting of casing followed generally accepted industry standard. Since Banjar Panji-1 is an exploration well, both kick tolerance and geological lithology are important factors in setting the casing. The LOT in BP-1 well at 13 3/8" casing shoe was 16.4 ppg, and this high value allowed elimination of 11 ¾" casing. Safety-wise, drilling without setting any casing down to 9,297 ft. was acceptable since the kick tolerance was clearly within industry accepted guidelines. The decision to drill into the top of the carbonate section before setting 9 5/8" casing was part of the lessons learned from offset wells. Similar decisions was made and followed by almost all operators in the area, including Pertamina, Mobil Oil, Kodeco and Santos.

The loss circulation events that were encountered starting the morning of May 27, 2006, were handled with prudence, in accordance to accepted procedures. The returns were restored by filling-in through the drill pipe, and no kick was detected. The pull-out procedures were slightly modified because of fluid losses, but the actions taken were well within guidelines of keeping the hole full so as to prevent any possibility of blow-out conditions developing.

The kick event on May 28th, 2006 – although of an unusual nature: a water kick rather than a gas kick – was handled properly. An Off-Bottom Volumetric Method was used to circulate the kick out of the hole, and it took less than two hours for the well to go dead. The subsequent surface breach, the development of several mud and fluid fumaroles along the fault line, and an inability to establish connectivity with the fumaroles flow regime via the well bore all indicated the futility of attempts to stop the mud and fluid extrusion through any methods available to the drilling personnel on the drill rig. Thus, at that time, it was a prudent decision to rig-down and move to ensure the safety of personnel and assets. The decision was made with proper authorization of upper management. We believe that staying on the hole at that time would have served no useful purpose, and would have exposed men and materials to an unknown and dangerous situation.

Overall, we found that the planning as well as actual drilling operations were conducted in keeping with accepted industry procedures and executed with high standards and due regard for safety of personnel.

2.0 INTRODUCTION:

There are three (3) important stages in drilling a well – (a) Pre-planning (b) Well design and (c) Execution of drilling. We have reviewed all three aspects from the reports provided by Lapindo. We were given full and open access to all the data related to the Banjar Panji well. All of the engineers and personnel at Lapindo cooperated in assisting us to better understand the Banjar Panji-1 (BP-1) drilling program. The following report summarizes our findings.

3.0 PRE-PLANNING:

Prior to drilling the BP-1 well, the G&G and drilling team met and assessed all the available and relevant data and information pertaining to the area. This collection of data included geological and geophysical information, leak-off test (LOT) values, identification of the presence of faults and fractured zones, expected pore pressure regimes across the cross-section, and the potential existence of shallow hazards.

The BP-1 well is located near Wunut field, which is currently under production from shallow formations at about 3,000 ft depth. There are several wells drilled in the field, and a good data base exists for leak-off tests at shallow depths. There is also good information available on pore pressure and shallow hazards in the area.

In addition to the shallow production at Wunut, there are several deep wells drilled by other operators. BD-wells were drilled by Mobil Oil to tap the deeper Kujung Formation in 1990's. Kodeco has drilled KE 11A thru KE 11H wells to explore the same targets. Huffco drilled Porong-1 well in 1993. This was the latest well drilled to explore the Kujung Formation, and it is a good analog for BP-1. The reports from these wells were carefully studied prior to drilling BP-1.

Porong-1 well was drilled to explore a gas play that was considered to have characteristics similar to the Arun field in Aceh Province. The drilling activity failed to reach the targeted depth because of heavy drilling fluid losses encountered in drilling the Kujung Formation. One of the key learning from the offset wells was the presence of a pressure reversal in the Kujung Formation. This pressure reversal was accounted for in the BP-1 well design. Under these circumstances, prudent drillers would aim to set casing to isolate the shale, and would set casing immediately after entering the Kujung Formation. The primary function of this casing would be to put behind pipe the abnormally pressured shales at depths of approximately 3500' to 6500'. This is a common technique for drilling deep wells where pressure reversal is expected, such as in the Gulf of Mexico. In the GoM, however, the transition zone from normal pressures to overpressures is typically found at a depth of 7,000' to 14,000'. In Indonesia, the transition zone to overpressured conditions is shallower due to higher subsurface temperatures that have resulted in rapid diagenesis of clays (compaction diagenesis, cementation effects and clay mineral transformations will all occur more rapidly and at shallower depths in a hotter environment).

3.1 G&G ANALYSIS:

The lithostratigraphic sequence and general geological setting was expected to be similar to that encountered in the Porong-1 well. A geophysical (seismic) cross-section comparing the two wells is shown in Figure 1. Note that the BP-1 well is in a more defined structure as compared to Porong-1 well. It appears that Porong-1 well was drilled close to the remnants of a fluid migration chimney. Such geological settings are prone to borehole instabilities and more variation in rock properties and *in situ* stresses. A better defined structure, such as in BP-1, would in general indicate fewer borehole stability issues and better well control characteristics.

There was, however, a major difference between the BP-1and Porong-1 wells: BP-1 well encountered an unexpected sand package below the shale prior to entering the target Kujung Formation, shown in Figure 2. The sand package is thick – 2,800' (approximately from 6300' to 9100') – and turned out to be hard volcanic sandstone. It appears similar in nature to turbidites, and may represent lahar material that came loose from the volcanic mountains in the vicinities and flowed into the depositional area as a liquefied mass. This would turn out to be an important difference as sandstones do not make good caprock (sealing rocks), and tend to act as bleed-off zones for elevated pressures. In contrast, shales are considered to be the source of pressure buildup because of compaction and constrained expulsion of water. They are highly impermeable if they are intact (unfractured), and thus tend to make good caprock.

The unexpected volcanic sandstone is strongly cemented because of the geochemical instability of the constituent grains, and the sandstone has a remarkably high stiffness in comparison to the overlying shale, and also to lateral rock units. In general, one would expect such a stiff material undergoing cementation diagenesis to also develop vertical fractures as the result of porosity loss.

Pressure estimates with depth for the BP-1 well were made based on data from the offset wells combined with geophysical log information. Figure 3 shows the geological sequence that was expected to be penetrated during the drilling of the BP-1 well.

LOT data was compiled for all the wells; the data available are shown in Figure 4. Both pore pressure and LOT information are considered to be critical in well design and selecting casing points in planning to avoid both blowout conditions and lost circulation through formation fracturing.

4.0 WELL DESIGN:

The intent of this report is to highlight the critical aspects of the well design. The basic parameters were reviewed in a report by Ralph Adams [1]. The reader is referred to his report for basic details of the well design.

It is important to understand that oil wells are drilled in stages. After each stage of drilling, the well is cased to isolate the shallower section from the deeper section to be drilled. The hole diameter (and hence the casing size) at every subsequent stage is smaller than the previous one. The step changes in hole diameter and casing sizes have been standardized in the industry to optimize cost and afford flexibility. Due to the limited choices in casing sizes, it is important to choose the casing setting depth as deep as possible for each size without compromising the potential risk from either higher pressures or lost circulation potential in deeper sections. Too frequent and premature use of casing strings runs the risk of running out of options, and not reaching the TD (Target Depth). These factors were included in the planning for the BP-1 well, and the assumptions were validated continuously while drilling so as to identify any unexpected variation.

The LOT (Leak-Off Test) is performed at each casing setting depth. The LOT pressure is used, as a rule, as the absolute maximum pressure allowed in the open hole section that will be drilled below the casing. In conducting a LOT, the operator takes the borehole pressure acting on the rock formation just beneath the casing shoe up to the point of hydraulic fracturing (the leak-off point). This is done just after drilling through the casing shoe, when there is about 10-20' of open-hole section exposed.

There are various means that a driller employs in estimating the pore pressure in the open-hole section while drilling, such as connection gas, drilling breaks, gas units observed in the drilling fluid, and flow-checks. All such indicators were noted and accounted for while drilling BP-1.

The shallow section of the BP-1 well was designed based on the Wunut 2 offset well, the closest producing well, less than 2 km away. The deeper sections were based on several wells, including the failed well designs for BD-1, KE-11C, KE-11G and Porong-1, as well as the successful well designs for KE-11E and BD-2. A key lesson learned from the Porong-1 well was the existence of pressure regression of about 1 ppg in the fractured limestone that makes up the Kujung Formation. Hence, a decision was made to set the 9 5/8” casing after entering 15 to 20' into the Kujung carbonate, thus isolating the abnormally pressured shales that were expected above the top of the Kujung Formation. However, because of the presence of natural fractures in the carbonate, it was also expected that it might be necessary to set a contingency casing string with a diameter of 7” if a zone of severe lost circulation was encountered below the base of the 9 5/8” casing. This is a common approach, and it emphasizes the need to retain as large a hole diameter as is reasonable when entering the carbonate strata, in order to isolate any unexpectedly severe lost circulation zones. Figures 5 & 6 show the planned well design parameters and the wellbore schematic.

Overall, the well design parameters were found to match or exceed widely-accepted and prudent industry practices.

4.1 DRILLING FLUID SYSTEM DESIGN:

The Wunut shales and deeper 'blue' shales are water sensitive and highly reactive because they contain large amounts of swelling clay minerals (smectites). To minimize the risk of severe borehole instability problems arising, a synthetic oil-based drilling fluid (SOBM) was selected and used in the Banjar Panji - 1 well.

Over the past 10-12 years, there has been a shift towards the use of oil-base drilling fluids (OBM) for HTHP (High Pressure High Temperature) wells, and also in deepwater drilling where pore pressure and fracture gradients are close together so that the window of safety between pore pressure and lost circulation is narrow. The primary benefit of OBM is in drilling reactive swelling shales. Compared to water-based drilling fluid formulations (WBMs), OBMs are non-reactive, and thus tend to greatly reduce problems that may arise because of swelling and sloughing of shales and stuck pipe. Another important benefit of OBMs is in suppression of kicks because hydrocarbon gases entering the wellbore are readily dissolved in the oil phase of the OBM. While this is certainly true at deeper depths, the solubility of gas in oil also decreases as the kick migrates upwards in the annulus. Care should be taken in recognizing this behavior, especially when the kick reaches within 2,000' of the surface. All well control schools emphasize this behavior in the training program.

The use of OBMs in the critical sections was an upgrade in design, as all previous wells had been drilled with WBMs. It is clear from the drilling data that the selection of OBMs paid off, as the hole conditions were excellent with minimum downtime arising from swelling problems, tight-hole issues on trips, hole cleaning issues, or high torque conditions arising from excessive cavings in the annulus or differentially stuck pipe. In fact, hole control problems are often a consequence of poor hole stability conditions that lead to prolonged exposure of shales, swabbing and surging conditions during trips and connections, high equivalent circulating densities during drilling, mud rings, washouts (poor hole cleaning) and other problems. Thus, reduction of borehole stability problems in swelling, sloughing shales is widely and correctly viewed as a wise risk mitigation choice. The decision to use OBM reduced the risk of adverse incidents in the BP-1 well.

4.2 KICK TOLERANCES:

The well was designed for a kick tolerance of 0.5 ppg intensity and a gas influx of 10 bbls (kick). These values are typical in the industry. A trip tank was included to help detect kicks, and was used when necessary. Surge and swab events were minimized by controlled pumping and careful tripping policy. The risks of swabbing on pull-out and surging on run-in were also reduced because of the use of OBM. Mud logging and drilling personnel were instructed to monitor kicks actively from the PVT chart at all times, and to advise drilling supervisory staff accordingly. Any kicks were to be circulated out of the hole using the Driller's Method (see for example the CRC Press Monograph "Drilling: The Manual of Methods, Applications and Management"- 1997 – ISBN 15667024290). The drilling personnel were also instructed repeatedly to keep the bore hole full at all times.

Static Influx Tests (SITs) were performed as necessary. Connection-gas and background gas were used as indicators for formation pressure. The mud weight was adjusted during the drilling activity based on these key factors, which is normal practice in the industry.

4.3 MANAGEMENT OF CHANGE (MOC) POLICY:

Drilling programs are written in detail, accounting for most of the anticipated reasonable contingencies. Nevertheless, because of various sources of uncertainty, there are also surprises that may be encountered when the actual well is drilled. This is expected, and policies and practices are implemented so that drilling crews can take appropriate action when an unexpected situation arises.

Generally the available information of the lithostratigraphic details and the subsurface seismic stratigraphy is incomplete and fraught with uncertainty. Such uncertainties, when encountered, force the well design to be modified in "real-time" to accommodate the new information. To account for these uncertainties, a "Management of Change" policy was developed and used. Any modification to the well design is thoroughly discussed by the teams – drilling and G&G – for possible ramifications. The recommendations are then proposed to the senior management staff for their approval before executing the recommendations. This step was designed as a check-and-balance to ensure proper due diligence is undertaken at all times during the drilling operations in the interest of safety and risk mitigation.

5.0 RIG INSPECTION, TRAINING AND SAFETY HAZOP:

As per industry practices, third-party inspections were carried out on the drilling rig to ensure that the safety equipment and practices, as well as the quality-control checks, were up to industry standard [2]. A HAZOP was conducted to simulate "drilling on paper". The learning from this exercise was incorporated in the drilling program and communicated to teams appropriately [3]. All drillers, tool pushers and drilling supervisory personnel were required to take the well control refresher course [4]. Appendix A lists these items in more detail.

6.0 EXECUTION OF DRILLING PROGRAM:

The initial drilling of the well was slow because of mechanical problems that developed on the drilling rig. This is typical in any new drilling operation. Even with brand-new drilling rigs, such teething problems are encountered and are considered normal, as a warm-up period. Once the mechanical problems were resolved, drilling progressed rapidly. Ralph Adams' report documents the day-to-day progress in drilling the well, addressed in Appendix B. The daily drilling reports were also reviewed.

The casing design had to be modified to account for unexpected pressure buildup in the shallow shales. The 20” casing was expected to be set and cemented into place at a shoe depth of 1,237'. However, shallow connection gas and background gas in the drilling fluid forced the casing to be set at 1,192 ft. This is not a severe setback, but any loss of casing shoe depth when drilling in overpressured regions leads to an increased probability of the need for an additional (and undesirable) casing string.

Because of a steeper pressure build-up observed in the shallow shale sequence, the 13 ⅜” casing was set at a depth of 3,580' - higher than the planned depth of 4,537'. As a routine procedure, a leak-off test was carried out just after the casing shoe was drilled. A leak-off pressure of 16.4 ppg was obtained, which is slightly higher than the 16.1 ppg leak-off test value predicted in the drilling program for the casing setting depth of 4,537'. The leak-off information is shown in Figure 7, and confirms the excellent shale characteristics at the shoe. In other words, a higher LOT value was good news, indicating that the well could resist a shoe pressure higher than expected even for the planned deeper shoe. Table 1 below shows the various casing setting depths and associated leak-off tests.

After setting the 13 ⅜” casing, the 12 ½” section was drilled. It should be noted that the drilling operation went very smoothly in this hole section, in significant part because of the favorable hole behavior arising through the use of the OBM. The pressure buildup in the shales continued with depth, as expected, and the mud weight (MW) was increased gradually to 14.7 ppg. After drilling to ~6,200', a geological anomaly was found - a large sand body was penetrated instead of the shale that was found in the Porong-1 well. It turned out to be a very hard, tight sand of volcanic origin, possessing an exceptionally low porosity for that depth. The rate of penetration slowed from over 200 ft/hr to less than 20 ft/hr. Sands, in general, act as bleed-off points for pressure, in contrast to the shales where the high pressures are usually generated due to the processes of clay compaction and diagenesis. OBM across the sensitive shales, combined with the hard volcanic sands, provided an unusually stable borehole environment.

Thus, hole stability was really never an issue in advancing the 12 ½” hole, as is evident from trouble-free wiper trips and drilling logs - no problems associated with sloughing or caving, over-pulling, high-torque, tight hole or stuck pipe were encountered. Several trips were made to the bottom without any tripping difficulties or drilling problems. Risks associated with borehole stability problems were therefore at a minimum.

TABLE 1: Casing Setting Depths & Leakoff Tests

Casing	Drilling Program - Plan	Actual
30 "	Driven to 187 ft	Driven to refusal at 150 ft
20"	1237 ft with 12.8 ppg LOT	1192 ft with 13.0 ppg LOT
16"	3237 ft with 15.8 ppg LOT	2182 ft with 14.5 ppg LOT
13 3/8"	4537 ft with 16.1 ppg LOT	3580 ft with 16.4 ppg LOT
11/3/4"	6537 ft with 16.4 ppg LOT	Not required
9 5/8"	Set 10 to 15 ft into Kujung	Not run

6.1 ELIMINATION OF 11 ¾" CASING AND DEEPENING THE 12-1/4" OPEN HOLE:

Experienced drillers know from past applications the true value and limitations of the 11 ¾" casing string in this area. While it adds flexibility by providing one more size, it also has its challenges in running it. The clearances between this casing size and the corresponding hole size (~14" diameter) are too tight, leaving only a thin annulus for cementing. Quite often, we experience poor cement integrity behind the 11 ¾" casing string because of these tight clearances. In addition to this, surge and swab problem are amplified while running the casing because of the tight clearance between the 13 ⅜" and 11 ¾". This has potential for loss circulation and kick without having the drill pipe in the hole – a difficult scenario. It is for these reasons that this casing size is normally selected only as a contingency casing, with a strong preference to avoiding its use if the actual drilling conditions permit one to do so.

The three critical and positive observations made in the process of revisiting the need for a 11 ¾" casing string in the BP-1 well are:

a) A lower than expected pore pressure – 14.7 ppg as compared to the prediction of 15.5 ppg;
b) The excellent LOT value found at the 13 ⅜" shoe; and,
c) Excellent conditions of stability in the open borehole.

In the BP-1 well, the LOT value at the 13 ⅜" casing shoe was a robust 16.4 ppg, which exceeded expectations. In fact, the shoe test at 13 ⅜" was slightly higher than what was expected for the 11 ¾" casing shoe in the original drilling plan.

The well drilling of the 12 ¼" section went very smoothly. No borehole stability issues were encountered. In fact, this was the fastest hole section to be drilled in spite of the very slow penetration rates in the hard volcanic sand. Swabbing issues were looked into, but were considered insignificant because most of the hole section was "in-gauge" because of the hard sand being drilled. This is often referred to as a "gun barrel borehole", meaning that no breakouts or washouts took place.

Based on these observations, recommendations were made to eliminate the 11 ¾" casing string. Standard industry kick tolerance calculations indicated that it was feasible to drill to 9,400' with adequate tolerances to give a reasonable safety factor. During drilling, a check point seismic survey was conducted to ensure that the top of the Kujung Formation was identified to avoid "overshooting" and penetrating too deeply into the Kujung carbonate. This was considered as a risk that would increase the possibility of lost circulation. The results of the check point shot were inconclusive, probably because of the high stiffness contrast (and hence high seismic velocity contrast and poor seismic reflectivity) between the stiffer volcanic sand and the underlying, less stiff fractured carbonate of the Kujung Formation. Hence, a close watch on the drilling and logging activities was deliberately maintained to ensure that the drilling was stopped after drilling 10-15' into the Kujung Formation.

6.2 HANDLING OF LOST CIRCULATION FOLLOWING THE YOGYAKARTA EARTHQUAKE AND AFTERSHOCKS:

On the morning of May 27, 2007, slow but steady drilling was in progress at the BP-1 well. Special emphasis was being exercised in examining the drill cuttings to ensure that drilling would be stopped at the top of the Kujung Formation carbonate section. At 05:55 hrs, within five (5) minutes of the beginning of the Yogyakarta earthquake (275 km distant, magnitude 6.3) a small loss circulation of 20+ barrels was recorded. The losses were slow and gradual over 5 minutes, and were barely noticeable, but this was the first sign of any unexpected activity in the hole. Because of the moderate sensitivity of the measuring tank, it is not possible to pinpoint the beginning of lost circulation more precisely, but it seems certain that it was within a narrow time window just following the Yogyakarta earthquake.

For next 7 hours, several aftershocks were experienced (the major aftershocks of 4.8 and 4.6 occurred between 4 and 6 hours later), and then suddenly, at 12:57 hrs (May 27th), a massive loss circulation episode occurred where more than 200 bbls of mud was lost. After such massive losses, a kick was expected. However, no kick developed, indicating that the pressure in the Kujung Formation was lower than expected, and also indicating that it was extremely unlikely that there were any significant gas- or oil-containing zones in the open-hole interval that were under any significant pressures. A decision was made to slowly fill the hole through the drill pipe, and regain circulation. Slightly more than 200 bbls of 14.7 ppg OBM was pumped prior to regaining circulation. LCM was spotted at the bottom of the hole to heal the losses through plugging of the fractures that were surmised to have been encountered.

Because a large volume of drilling fluid was consumed in fighting the loss circulation episode and regaining circulation, four hundred (400) barrels of fresh drilling mud was mixed. The well remained static for over 7 hours while building this mud volume as the well was circulated on the trip tank. With a static wellbore clearly in evidence, no losses and no gains, a decision was made to pull out of the hole and run casing. Because of the stable quality of the borehole and the success in controlling the lost circulation, no problems were anticipated with this procedure.

6.3 PULLING OUT AND HANDLING A KICK:

The details of the pull-out procedure are recorded in detail in Ralph Adams' report [1]. In summary, the pullout process ensured that the casing was always kept full of fluid. While some losses were encountered when filling the hole after pulling the pipe, the net volume pumped exceeded the losses. To conserve and ensure adequate drilling mud on hand, the pull-out procedure was modified to pull 3-4 stands at one time, instead of one stand, before pumping three times as much mud as was required by pipe displacement and swabbing. This would displace any influx from the hole if such influx had been swabbed in during the pulling of the pipe. The swabbing was not an important consideration for wellbore behavior through the hard volcanic sand (gun-barrel borehole), as the pressure fluctuations arising from the swabbing were small compared to the rock's strength. The overall procedure of pulling and filling is analogous to a floating drilling mud cap where an excessive amount of drilling fluid is pumped into the annulus to keep the well dead while tripping.

The pulling-out procedure proceeded smoothly from 9,297' ft to 4,336' when water influx was detected. No gas was observed, therefore the pull-out process continued for one more stand (~90' of drill pipe) when the water influx rapidly increased. The well was shut-in at 07:53 AM on May 28th, 2006, with the drill bit at a depth of 4,246', approximately 666' below the casing shoe. The casing pressure rose slowly to 1,050 psi prior to leveling off. The well-killing operation was initiated using Off-Bottom Volumetric Method as is typical for such situations. The pressure was bled through the choke, and by 09:55 AM, the well was dead; the kick had been controlled and was no longer a danger to the wellbore.

6.4 SURFACE BREACH & FOLLOW–UP MANAGEMENT OF OPERATIONS

Once the well was dead, an attempt was made to resume the pull-out procedure; however, the pipe was stuck. The rig crew worked the pipe with a maximum pull of 400,000 lbs, but without success. Several other procedures including jarring and spotting a high-viscosity drilling fluid pill were tried for 20 hours, but without success. Then, gas and water (plus steam) – a fumarole – broke out at the surface 200 meters away from the borehole at 03:30 hrs on May 29th,2006 (Figure 8).

Attempts were made to pump weighted mud through the drill pipe to control the flow out of the fumarole, but no connectivity was observed with the well, which was dead (neither flowing nor experiencing lost circulation). The flow from the fumarole continued to increase with two other fumaroles popping-up across the toll road, some 500 meters away from the drill site (Figure 9). In spite of trying to pump heavy mud in the wellbore, no fluid connectivity (i.e pressure response or fluctuation, inflow or efflux) was observed between the wellbore and the fumaroles. Several attempts were made to pump LCM and cement to control the mud flow rate in the fumaroles but with no success. For some reason, the borehole had become totally disconnected from the induced fracture system that was bringing liquids, gas and mud to the surface as fumaroles.

With the flow rates from the fumaroles continuing to increase, the danger of flooding the area surrounding the rig began to increase. A ground crack also was noted around the rig site under the pipe-rack (Figure 10).

With the ground crack under the pipe-rack and mud starting to flow over the berm wall into the drill site, a decision had to be made in the field either to stay on site or to abandon the well and demobilize the rig. The decision was made to abandon and demobilize the rig because of safety reasons. Staying on the well at that time would have served no useful purpose, and would have exposed men and materials unnecessarily to an unknown and dangerous situation. Proper management authorization was secured in finalizing the rig-down command.

7.0 CONCLUDING REMARKS:

This report is the first in a series of two reports reviewing the drilling activities at Banjar Panji-1 well. The primary purpose of this report was to examine the due diligence conducted by the drilling and G&G teams in planning and executing the drilling program. Overall, we found that the planning and actual drilling operations were conducted in keeping with accepted industry procedures and that high standards were maintained. There was good integration of the efforts of the G&G and drilling teams in executing the drilling program.

The loss circulation and kick events were handled appropriately with accepted industry practice, given the data available to the drilling crews. It is unlikely that different procedures would have been followed by others using the same equipment in the same circumstances. Although the kick was of an unusual nature – a water kick instead of the more common gas kick – it was handled properly. An Off-Bottom Volumetric Method was used to circulate the kick out of the hole and kill the well, and it took less than two hours for the well to go dead. The subsequent surface breach, the appearance of several fumaroles along the fault line, and a total inability to establish contact with the fumaroles flow regime via the well bore indicated the futility of attempts to stop the mud flow using the activities available from the drill rig (injection of material). A prudent decision was made to rig-down and move to ensure safety of the personnel and the assets. This was done with proper authorization of upper management.

The second report will investigate the cause of the water kick and the subsequent development of fumaroles and breach of mud to surface. Detailed review of the mud blowout has been carried out based on geological parameters, wellbore fluid mechanics, pore pressures, drilling parameters and rock mechanical understanding. In conclusion, the report will show that there is no evidence of fluid migration through the wellbore. A mechanism will be proposed whereby the 275 km distant Yogyakarta earthquake and its aftershocks are implicated in compromising the aquifer seal integrity. The pre-existing but dormant fault system and associated natural rock fractures ended up being the conduit for the fluid flow. This report is due to be released by the end of September, 2007.

Figure 1 Geophysical Description of the Trend

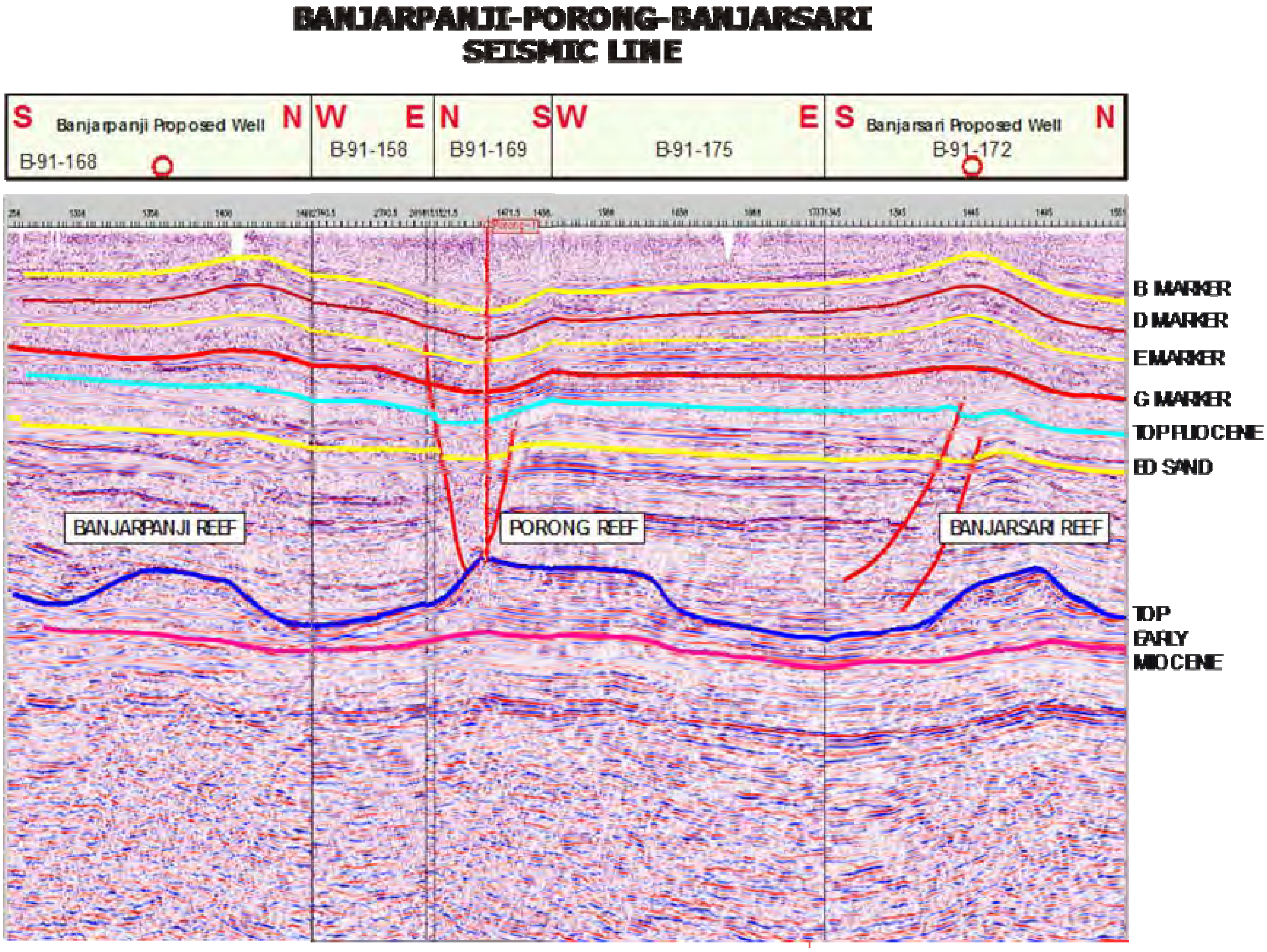
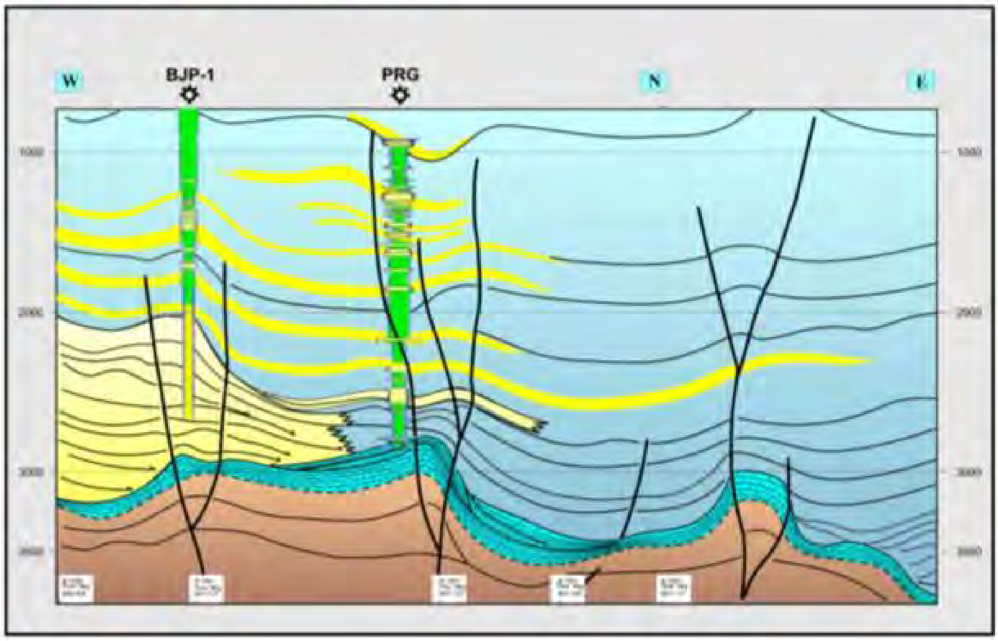


Figure 2 Geological setting comparisons
between Banjar Panji -1 & Porong -1 wells

Interpretations



Banjarpanji-1

- Big gap in stratigraphic succession, Early Miocene carbonate is overlain by Plio-Pleistocene volcaniclastic sediments consisting of interbedded sand and shale.
- The Pliocene tight laharic debris volcaniclastic sandstone above the Early Miocene carbonate thinning towards East.
- Overpressure shale developed above the Pliocene Volcaniclastic reaching a thickness of up to 2500 ft. This shale sequence thickens to the North and East of Banjarpanji-1.

Porong-1

- Biostratigraphy analyses indicate at least 10 My gap between Early Miocene carbonate and the overlying shale.
- The Pliocene laharic debris volcaniclastic sandstone is thin, and thick shale developed on top of carbonate sequence.
- Reefal and open marine carbonate facies developed in Early Miocene Kujung. In terms of reservoir quality is good.

Figure 3 Geological description of lithology expected in Banjar Panji -1 well

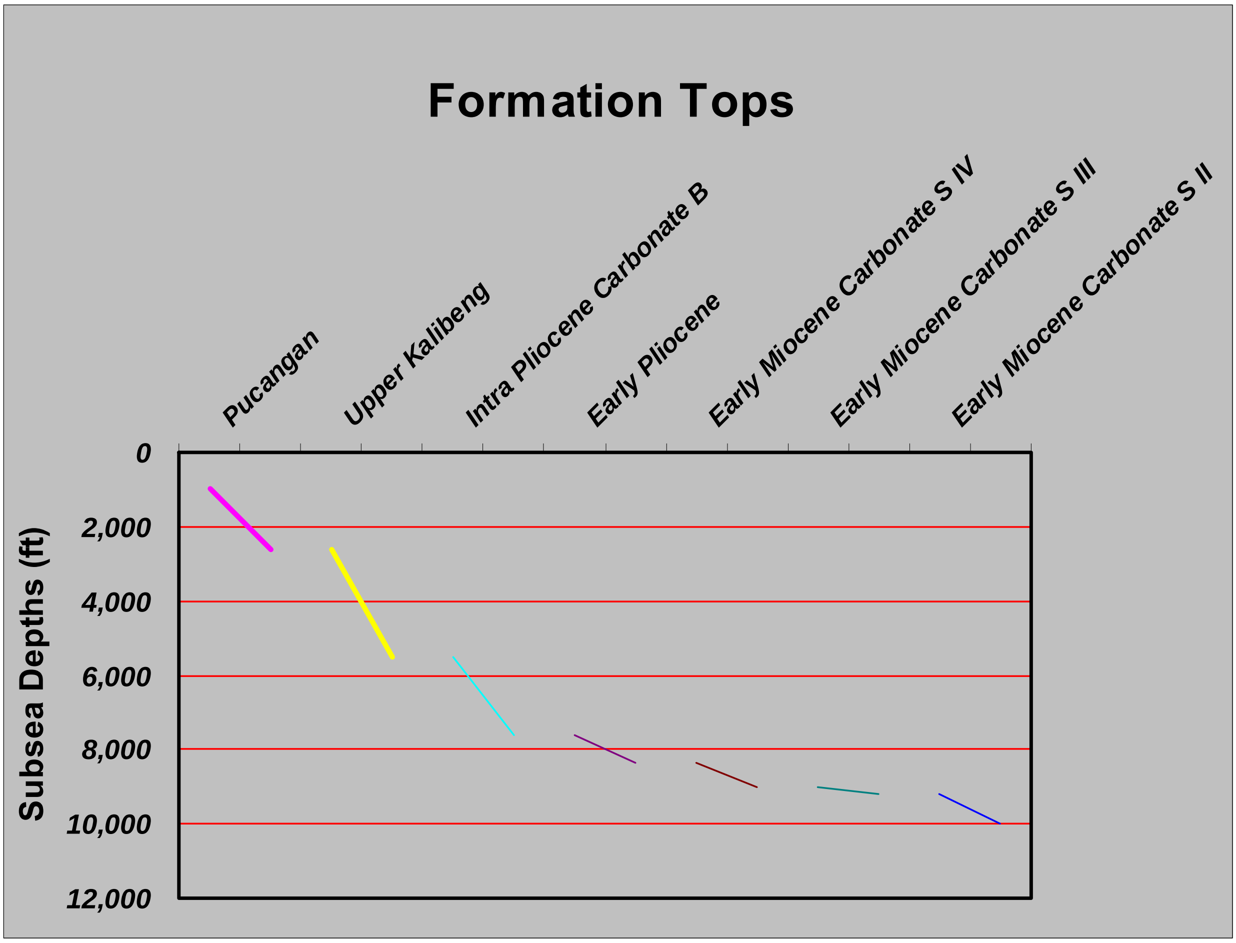


Figure 4: Compilation of historical data on leak-off tests from the region

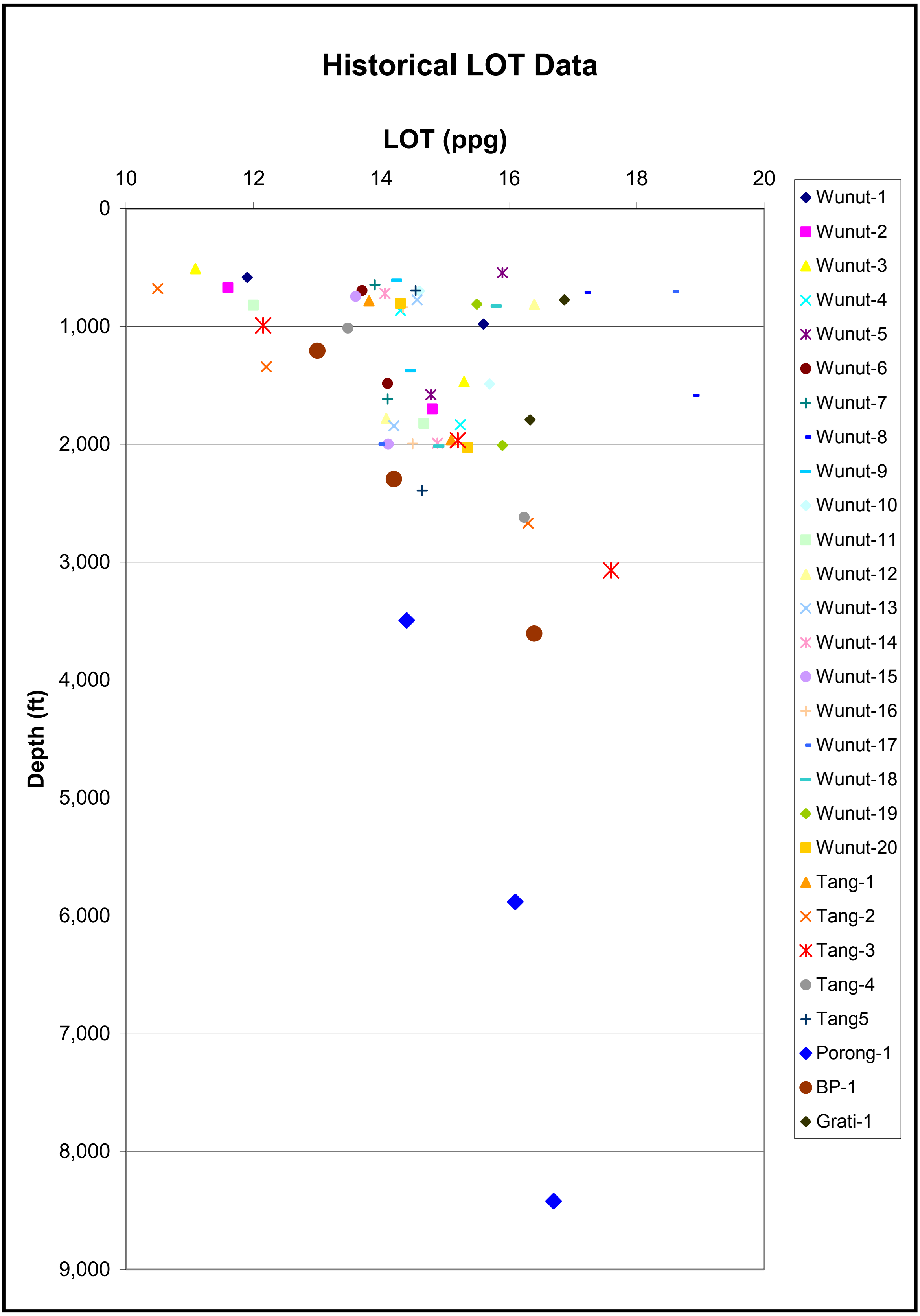


Figure 5

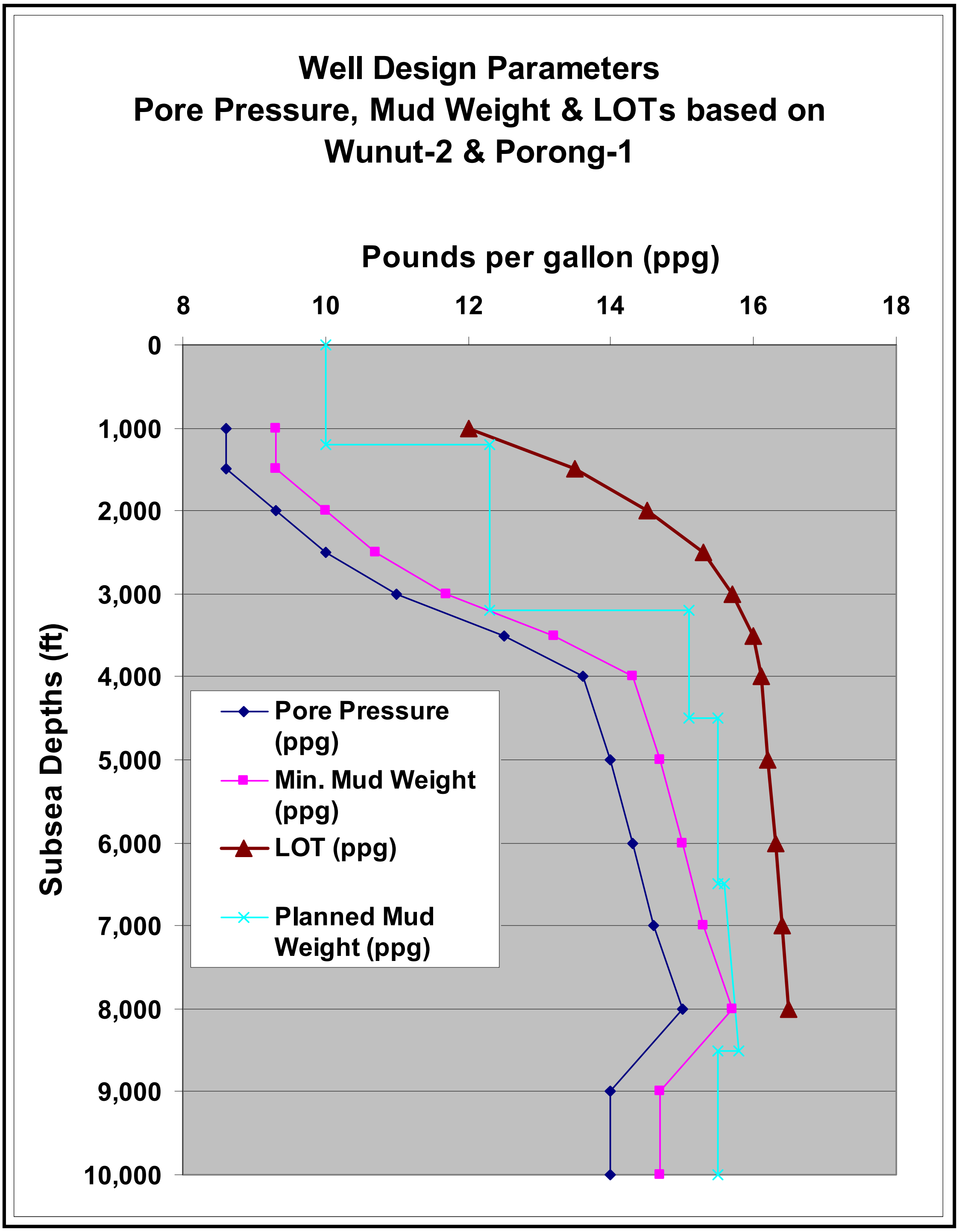

Well Design Parameters
Pore Pressure, Mud Weight & LOTs based on
Wunut-2 & Porong-1
Pounds per gallon (ppg)
8
10
12
14
16
18
Subsea Depths (ft)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Pore Pressure (ppg)
Min. Mud Weight (ppg)
LOT (ppg)
Planned Mud Weight (ppg)

Figure 6

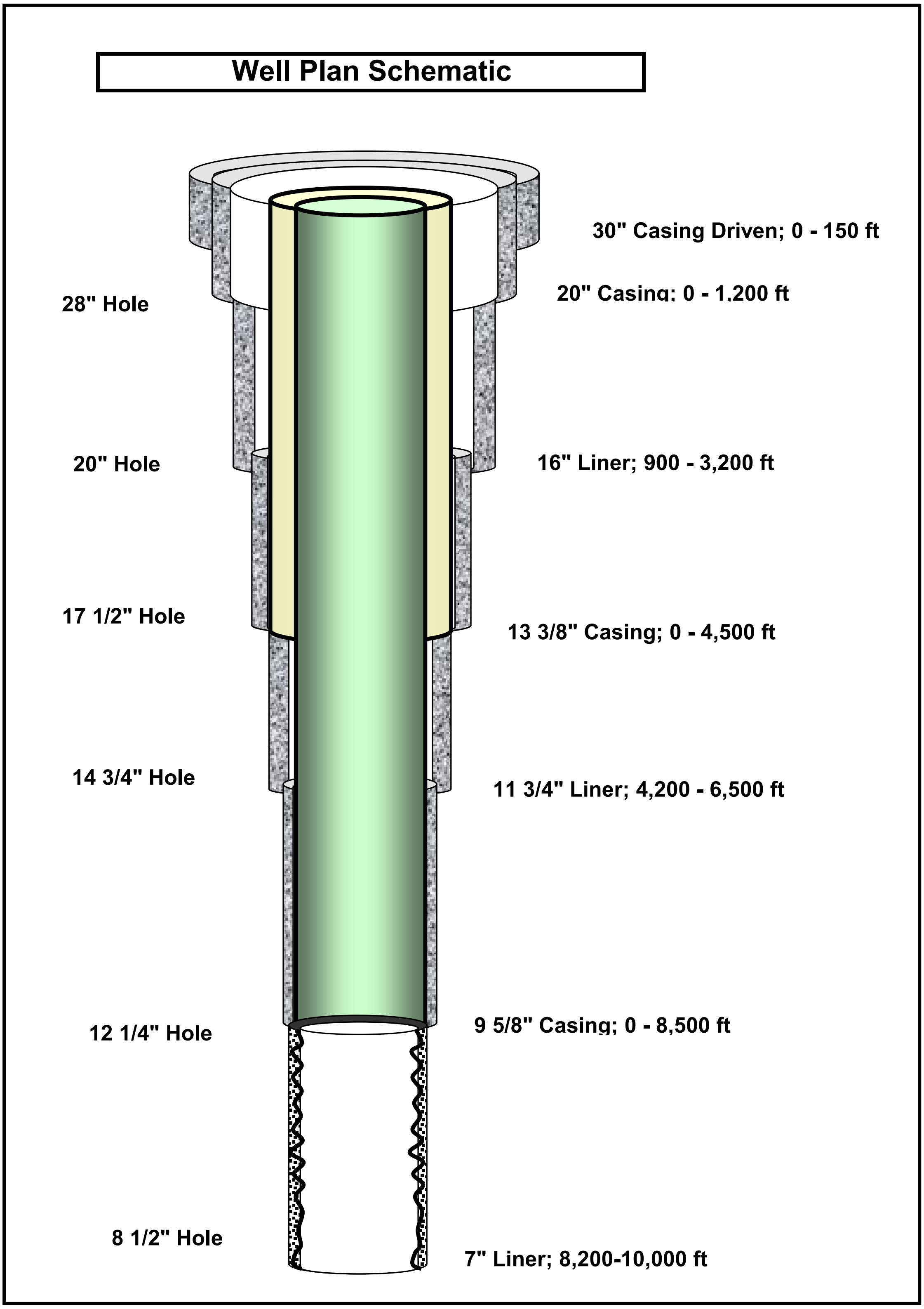

Well Plan Schematic
30" Casing Driven; 0 - 150 ft
28" Hole
20" Casing: 0 - 1,200 ft
20" Hole
16" Liner; 900 - 3,200 ft
17 1/2" Hole
13 3/8" Casing; 0 - 4,500 ft
14 3/4" Hole
11 3/4" Liner; 4,200 - 6,500 ft
12 1/4" Hole
9 5/8" Casing; 0 - 8,500 ft
8 1/2" Hole
7" Liner; 8,200-10,000 ft

Figure 7: Actual leakoff test data at 13 ⅜" casing shoe in Banjar Panji-1 well

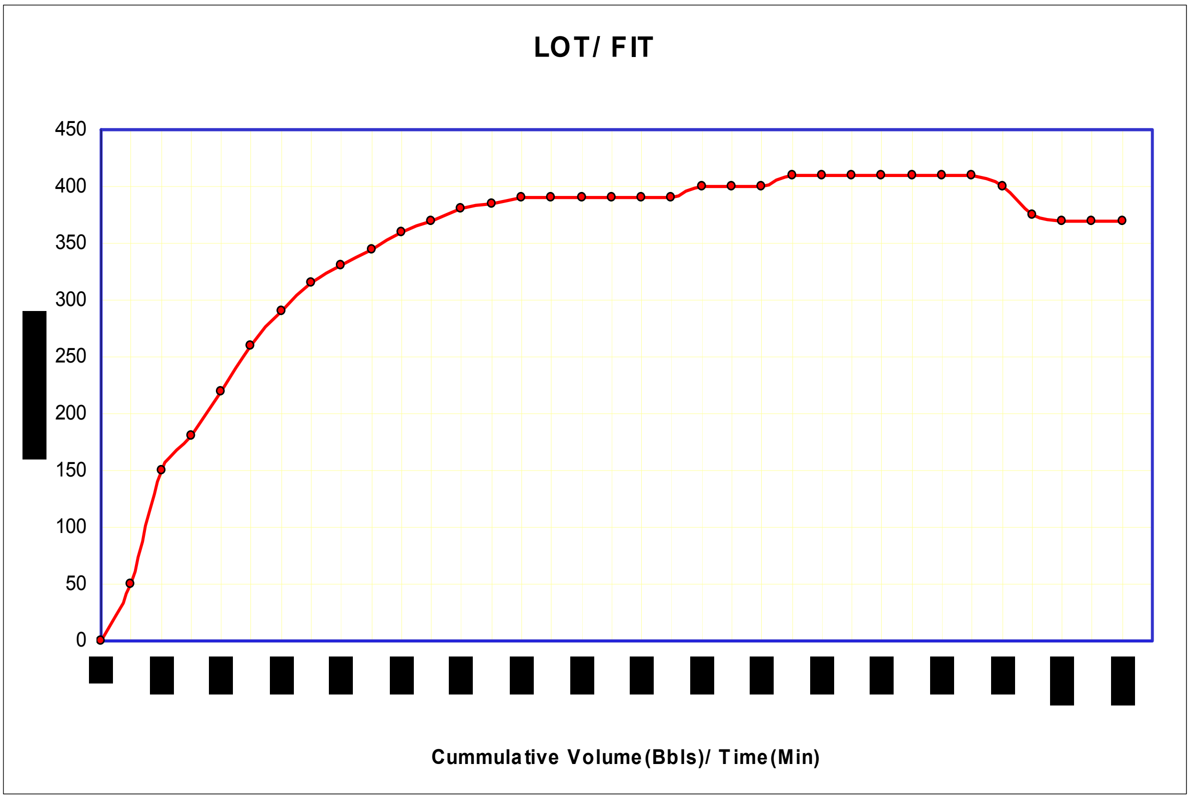


Figure 8: Surface breach & fumarole 200 meters away from the rig on May 29th, 2006

Figure 9: Two more fumaroles initiating parallel to a fault line, including the relative location of the well

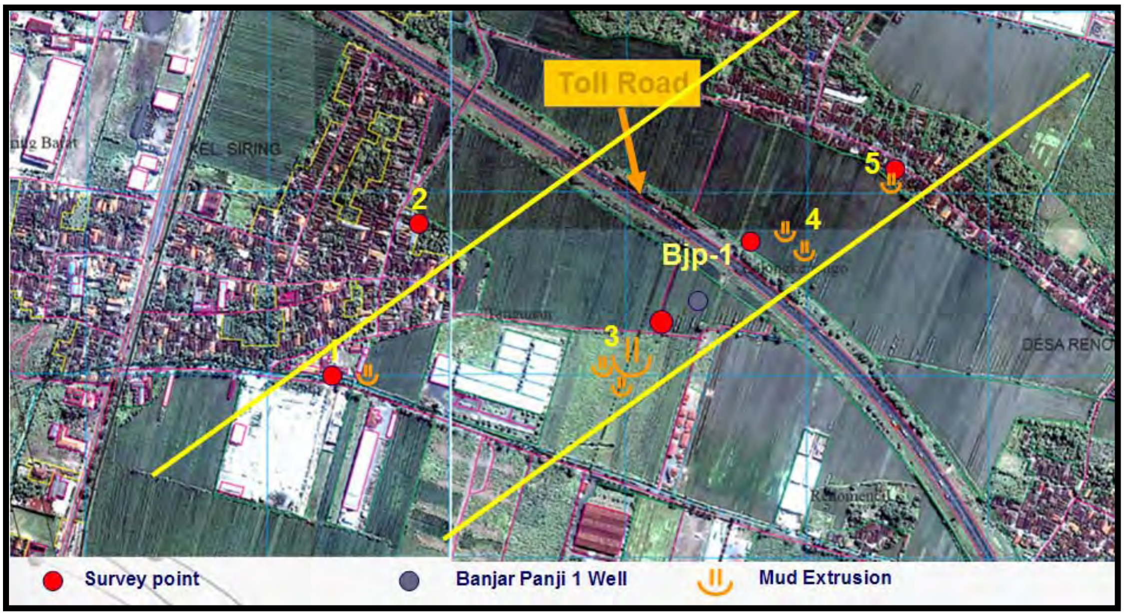
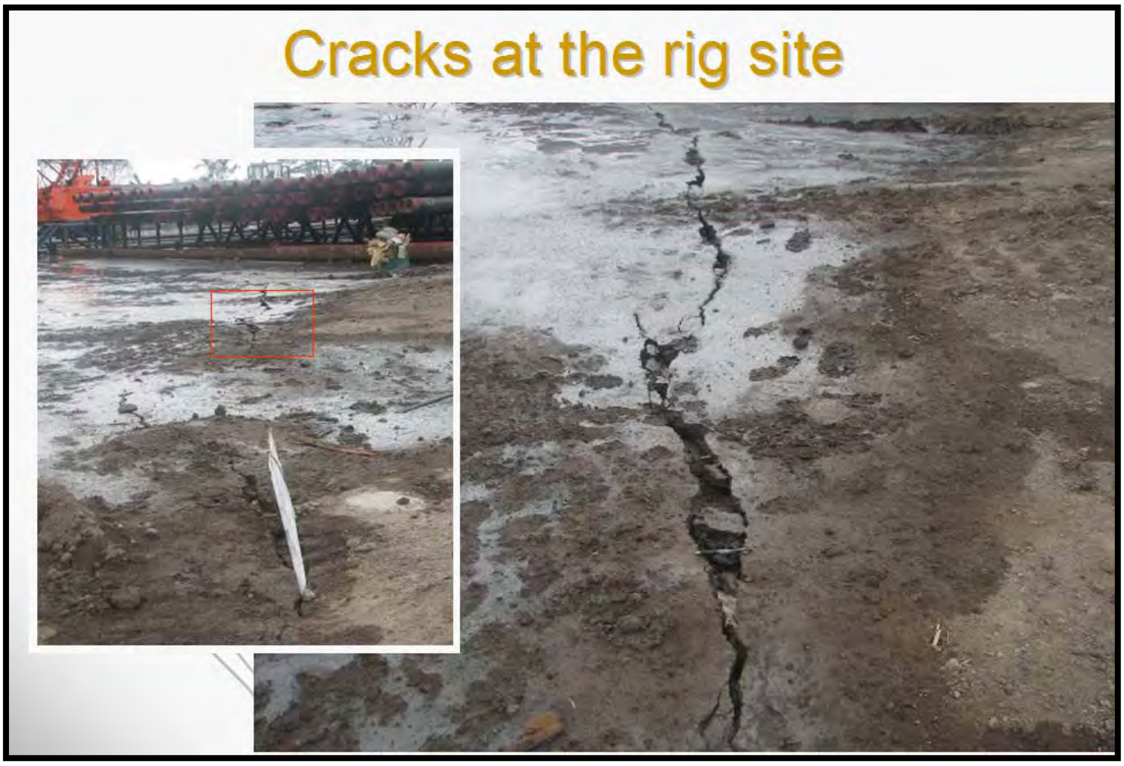


Figure 10
A crack develops near the pipe-rack in the vicinity of the rig



APPENDIX A

STANDARD INSPECTIONS

ModuSpec Check:

Prior to spudding the well, the contractor was asked to have a third-party comprehensive inspection on the rig condition. ModuSpec International was recruited for inspection and subsequent follow-up upgrades [2[.

Well Control Refreshers:

All the drillers, tool pushers and supervisors were sent to a well control refresher course as a pre-requisite to be on the rig.

Third-Party Services:

Internationally reputed Service Companies were recruited for supporting the drilling operations. M-I was chosen for mud support, Halliburton was selected for cementing services, Baker Atlas for wireline support and Weatherford was retained for wellbore tubulars. Elnusa provided support in Mud Logging

HAZOP Check:

Following the inspections and well control refresher noted above, a HAZOP analysis was done where all drilling teams – including service companies – were invited to conduct “drilling on paper” [3]. The learnings from this exercise were incorporated in the drilling program, and communicated accordingly.

APPENDIX B

17 ½" Hole Section & 13 ⅜" Casing

- Drilled with a 14 ½" x 17 1/2" Bi-centered bit
- Drilled out with 12.3 ppg SOBM, increased mud weight to 13.3 ppg by 2578 ft due to sloughing shale and hole conditions
- Had to terminate operations for 18 days to replace mud pumps and shale shakers.
- Drilled to 3995' where mud weight had to be increased to 13.8 ppg due to positive SIT.
- Had meeting with Partners were it was agreed to set casing based on sloughing Shale and Dc Exponent which confirmed increase in pressure
- Ran and cemented 13 ⅜" casing at 3580 ft, 957 ft higher than proposed in the drilling program.
- Drilled out and tested the 13 ⅜" shoe
- LOT – 16.4 ppg EMW

14" Hole Section for 11 ¾" Liner

- The 16.4 ppg LOT on the 13 ⅜" shoe at 3580 ft was the same as the predicted LOT for the 11 ¾" liner that was to be set at 6537 ft
- MCN proposed to eliminate the running of the 11 ¾" liner if the LOT was in excess of 16.2 ppg in their Management Change Letter of May 2nd
- The 11 ¾" liner was not required based on the LOT result and to eliminate problems with running and cementing the 9 5/8" casing due to the small annular clearances.

12 ¼" Hole Section for 9 5/8" Casing

- The 14.2 ppg mud weight was increased to 14.6 due to gas units and to 14.7 due to 760 units of trip gas at 4290 ft.
- Partners agreed to set casing 10 to 20 feet into the Kujung Formation, as specified in the drilling program, at a meeting for testing the well on May 2 while drilling at 8040 ft.
- Drilled to 8750 ft (213 ft below proposed top of Kujung) with 14.7 ppg mud
- Mud weight was sufficient as there were 4 wiper trips to the shoe for rig repairs and 3 full bit trips with no hole problems
- Ran logs and VSP survey to determine the depth to the top of the Kujung Formation, but the VSP results were inconclusive.
- Top of Kujung was estimated to be between 8800 and 9600 ft based on VSP log interpretation
- Determined the maximum safe drilling depth with 14.7 ppg mud to be 9400 ft. Notified partners of plan to drill into the Kujung Formation as was agreed in the meeting or to a maximum depth of 9400 ft
- Drilled to 9010 ft performed SIT, results negative.

- At 9225 ft the H_2S monitor at the shakers recorded 25 ppm of H_2S but there was no limestone in the drill cutting samples, so the assumption was made that it was a false alarm.
- Drilled to 9283 ft, circulated for samples without seeing any evidence of the Kujung Formation limestone.
- Drilled ahead, lost total circulation at 9297 ft on May 27th at 12:57 pm

General Observations on Drilling Program

- Drilling program is detailed and covers all the potential problems and the mitigation actions required
- The Well Control section of the Drilling program specifies the well should be shut-in if there is a kick and that a "Hard Shut In" is acceptable and the well should be killed with the Drillers Method.
- The selection of the casing setting depths were dictated by mud weights and hole conditions and were within Kick Tolerance criteria
- The LOT for the 13 ⅜" shoe is a valid LOT and it is sufficient to justify not setting the 11 ¾" Liner.
- The setting depths were determined by mud weight, hole conditions and Kick Tolerance and all casing setting depths were optimized
- The proposed by MCN to eliminate the 11 ¾" liner if the LOT was over 16.2 ppg was based on sound drilling engineering principles and operational concerns
- The 16.4 ppg LOT for the 13 ⅜" shoe is a good LOT and is not subject to any subjective interpretations
- The decision to extend the 9 5/8" casing seat to a maximum depth of 9400 ft was a good decision under the circumstances because:
    - The 14.7 ppg mud weight instead of the predicted 15.6 ppg mud weight provided sufficient Kick Tolerance to drill to the deeper depth provided there were no increase in mud weight
    - To be able to test the open hole interval below the shoe it requires the 9 5/8" casing to be set into the Kujung formation
    - Hole conditions below the shoe were excellent

REFERENCES

1. Adams, Ralph, Banjar Panji -1 well control incident report, Internal Report, Energy Mega Persada, Jakarta, November 8, 2006.

2. Inspection Report, ModuSpec International Ltd, Labuan, Malaysia, October 20, 2005 and update March 3, 2006.

3. Hazop Report, Learnings, Energy Mega Persada.