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Mr Andy Jacob
Chief Operating Officer
PTTEP Australasia (Ashmore Cartier) Pty Ltd
Operator's Representative, Montara Wellhead Platform facility
Level 1, 162 Colin Street,
West Perth 6005

Dear Mr Jacob

Prohibition Notice 0222 – Montara Wellhead Platform (WHP) facility

I refer to your letter dated 7 September 2009 and attached supporting document, Montara H1 ST1 Well Release Response – Case for Safety Revision 2, 7 September 2009.

NOPSA has considered the material you have submitted in response to the prohibition notice No 0222. With respect to our letter dated 3 September 2009 in which we sought clarification of a number of matters, I draw your attention to the following observations with regards to your current submission:

1. An assessment of the risk of ignition and its consequences at the Montara WHP prior to any deluge intervention has not yet been provided, noting
   - Section 1.2 provides some historical data that indicates that 83.6% of blowouts in the data set did not ignite and of the 16.2% that did ignite, 84% did so within 24hrs. No comment or inferences are drawn from this material.
   - Section 2.1 states that in all cases other than static electricity, ignition is "unlikely" and for static electricity it is "possible". Spark from abrasive formation rock that hits derrick metal is discounted on the basis the well conductor is largely blocked by a cement plug although there is no consideration given to the status or condition of the plug over time. Similarly there is no discussion of any consideration with regards to the ongoing potential for momentum from the release to dislodge an object.
   - The first option at the bottom of page 8 of the submission highlights that the only option with no adverse safety consequences is to not undertake the deluge operation, ie. for the remain outside of the 2Nm zone whilst the release remains unignited hence not exposing personnel to the threat posed by the ongoing hydrocarbon release or the immediate consequences of ignition should it occur.

2a. Identification of the additional contribution to the likelihood of ignition and its consequences from the presence of the vessels at 60m -100m from the Montara WHP has not yet been provided noting:

- That the aggregation of consequences within Appendix 1 of appendix 2 (Vessel Approach HAZID) makes it impossible to determine the extent to which the presence of the vessels within 60-100m of the WHP may contribute to the likelihood of ignition.
- There is no evidence to indicate that a formal ignition analysis has been undertaken and that all potential sources of ignition on each of the deluge vessels have been appropriately investigated.
- There is no evidence to demonstrate that potential sources of ignition from vessel activities have been investigated ie 'nudging' from support vessel in case of loss of DP, sources on the support vessel itself given that it may enter the gas cloud for emergency response in loss of DP, deluge vessel collision, etc.

2b. Identification of the additional contribution to the likelihood of ignition and its consequences from water deluge physical impact and including for example, turbulence effects and potential discharge of electrostatic energy from electrically isolated slugs of water has not yet been provided noting that:

- The physical impact of the deluge in terms of the potential to increase the likelihood of dropped objects within the flammable zone but outside of the physical effects of the release itself have not been considered;
- On page 8 of the body of the submission it is stated that "The effect of water spray on the probability of ignition was also investigated. It was found that the water spray did not prevent ignition occurring – an ignition point on the outside of the spray resulted in flash back through the spray." The Executive Summary of the Consequence Modelling notes in relation to the proposed water spray: 'it would not prevent ignition of the flammable gas cloud and may even increase the potential for ignition due to the dislodgement of projectiles, generation of static, etc.' This is a clear risk at variance with the stated aim of the proposed activity.
- On page 8 of the body of the submission it is stated that "flame speed actually increased due the increase the increase in turbulence induced by the water spray". Further, the follow on discussion regarding the resultant increase in overpressures, discounted in the case of open air is not explored in the context of the congestion indicated in the vicinity of the release.
- Although the submission quotes from AS/NZS 1020:1995 (The Control of undesirable static electricity) section 6.1.4 p25 of this standard also states "Despite this [with respect to the conductivity of a particular liquid being indicative of its tendency to generate static] a relatively conducting liquid spray at high speed from an earthed nozzle or pipe will probably be electrostatically charged."
- The Risk Assessment notes that the angle of attack for deluge application is included in Appendix 3. The elevation shown in Appendix 3, with marked dimensions, appears to show a horizontal approach of the order of 30m or less. The diagram also suggests that the water jet is orientated directly into the wellbay, which will tend to contain "rich' hydrocarbon mixtures, however photos of the release (and modelling) suggest that the gas cloud could extend a lot further than this. It is not clear what areas of the gas cloud will be addressed by the deluge activities.

3a. Other than the name of the model, details of the model selected, the basis for selection and details of the validation of the model for this application have not yet been provided, noting:

- The model is unable to perform calculations representing calm conditions for either methane or heavy hydrocarbons.
- The ability of the model to be influenced by ambient temperature, solar radiation effects, humidity etc, is not discussed. The weather conditions modelled do not reference the actual site conditions which would be expected over the time frame proposed for the activities.
- There has been no attempt to validate the model predictions based on observations and actual data gained at the site to date. Neither has there been any attempt to validate the predictions using results from other models.
- There is no evidence of sensitivity analysis performed on assumptions made.
- Flash fire and explosion modelling on a single base case with an assumed LFL volume of a sphere of 6m radius would appear to underestimate both the flash fire risk and the explosion risk, especially for calm conditions.
- The choice to model based on unconfined explosions is considered inappropriate given the congestion of structures in the area. There is no discussion of projectiles and their effect resulting from explosions.
- The limit of 20% LEL has been adopted as an operational control for deluge vessels however there has been no attempt to model it at increased mass release rates. This omission does not support a risk management approach to the proposed activities.
- Results from the modelling in Appendix 1 have been erroneously transcribed into the case for safety report (table 2.1) with significant deviations in some figures presented.

3b. The basis for only modelling methane and ignoring the components that would tend to slump e.g. condensate entrained in the water vapour has only been partially addressed noting:

- The revised report (Appendix 1) now acknowledges the risk from heavy end gasses and states that "However, the heavy gas will extend down to sea level and is therefore a greater threat to a vessel in the event of wind change or calm conditions'. Fire and explosion modelling has not been carried out for the heavy gas component
- It is not clear how gas detectors will be calibrated to account for the possibility of heavy gases as well as methane.

3c. The basis for ignoring the condensate slick and the vapours being emitted from it has only been partially addressed noting:

- The basis appears to be that "When the liquid comes into contact with the sea, it is rapidly cooled and is hence stabilised", however this assertion is not substantiated by any representative met-ocean data (see item 3d below).
- The oil slick and associated boil-off are potentially significant factors during high day time temperatures. As these vapours are at the same level as the vessels they are a potential threat. An operational limit is placed to prohibit deluge vessels from operating within or adjacent to the slick however there has been no attempt to specify safe operating distances to define "adjacent'. Ignition of the oil slick vapours is considered to present a real escalation threat for the release in general.

3d. information that substantiates the assumed wind speeds or information that is demonstrably representative of the meteorological and met-ocean conditions at the site for the anticipated duration of the event has not yet been provided. The lack of this data as an input into the modelling erodes the credibility of the modelling and raises further questions with respect to the extent to which the vessels can respond to varying conditions and the extent to which the quadrant shown in Appendix 3 of the submission will be "upwind" throughout the anticipated duration of any proposed pre-ignition deluge activities.

3e. There remains a lack of any modelling to support the conclusion that the deluge activities will result in more efficient dispersion noting the information provided on pp 10 & 11 of Appendix 1 is not consistent with the scenario that the proposed activities pose. There remains no detailed consideration of displacement effects noting:

- In the last paragraph on page 5 of the body of the submission it is stated that "The gas dispersion models shown in appendix 1 would indicate that wind conditions up to 10m/s (~20 knots) will only significantly change the dispersion characteristics at the lower end of the flammability range ". If this is the case then it remains unclear what the real benefit of deluging to create the effect of a natural wind to aid in dispersion is. This form of mitigation is illogical in an uncontrolled flow situation.
- There is still no consideration of displacement effects, ie creation of pockets of gas out-with the modelled plume configuration.

3f. The assumption that the deluge will scrub the condensate remain unsubstantiated.

In addition to the clarification points above, observations showing some of the issues raised by personnel in reviewing the material you have provided are contained in attachment 1.

Based on the material provided to date, NOPSA has not been satisfied that the immediate threat to health and safety of personnel at the facility has been removed with respect to proposed deluge activities prior to ignition of the uncontrolled release of flammable hydrocarbons.

Consideration has been given to fire fighting and associated emergency response activities you may seek to undertake in the event of ignition of the uncontrolled release of flammable hydrocarbons. In taking these considerations into account I hereby advise that Prohibition Notice No. 0222 ceases to have effect on the basis that Prohibition Notice 0223 has been issued which prohibits all activities that involve the placement of people at the facility other than if they are located on a marine vessel at the facility solely for the purpose of fire fighting activities (including any consequential emergency response activities), subsequent to ignition of the uncontrolled release of flammable hydrocarbons.

You are reminded that as the operator of the facility you continue to have a duty to take all reasonably practicable steps to ensure that all work and other activities carried out on the facility are carried out in a manner that is safe and without risk to any person at or near the facility. Further to this reminder I note the current 2Nm marine exclusion zone established by the Australian Maritime Safety Authority, the location of the West Triton some 2km from the Montara Well Head Platform and that a 500m safety zone exists around the Montara Well Head Platform. In discharging the aforementioned general duty you must give due consideration to an appropriate stand-off distance for any marine vessel that may undertake fire fighting (inclusive of any consequential emergency response activities), particularly with respect to the hazards and risk from projectiles that may be associated with an explosion event resulting from ignition of the uncontrolled release of flammable hydrocarbons.

Yours sincerely

Simon Schubach
Acting Chief Executive Officer

11 September 2009

Attachment 1

- The "(assumed) lower potential for ignition due to the application of deluge" is explicitly refuted in the executive summary of Appendix 1 "it would not prevent ignition of the flammable gas cloud and may even increase the potential for ignition due to the dislodgement of projectiles, generation of static etc." and again, more specifically on page 11 of Appendix 1 "It was found that the water spray did not prevent ignition occurring – an ignition point on the outside of the spray through which gas was passing resulted in a flash back through the spray".
- Whilst the submission make no inferences from the information presented in section 1.2 it is noted there appears the data suggests the likelihood of ignition reduces with time. It would also appear that of the three certain sources of ignition cited one (dropped objects) may still credible in this scenario.
- The HAZID remains unchanged from the first submission and does not include specific consideration of any vessel other than the Havila Harmony with respect to input from associated personnel or any of the unique characteristics of such vessels.
- The proposed deluge operations are not described in sufficient detail - this reduces the ability to thoroughly identify all the hazards.
- The proceedings of the HAZID do not include all activities associated with the operation, for example: emergency response, normal vessel operations, adverse weather, interaction between vessels, scenarios involving diverging wind and currents, variability in the size shape and location of the slick.
- The potential hazards from the deluge activity itself needs further investigation such as its impact on any loose objects which may fall and cause sparks or ignition;
- The screening of the HAZID outputs for potential MAEs is inconsistent - there is no description of why particular events have been carried forward for additional assessment.
- The terms 'water spray', 'water spray barrier', 'water curtain', 'water screen', 'water jet', 'water deluge' are all referred to interchangeably within the text of the report and the quoting of cited references. No description is provided on the actual configuration of the intended deluge application, the quantity of water, droplet size and expected behaviour, how many monitors will be in operation simultaneously, their reach reliability and performance in a variety of weather conditions.
- With respect to 'protective deluge' as described on page 13 paragraph 5 it would appear that the ability of the vessel to move away rapidly would disable the provision of a protective deluge as the hose may no longer be sufficiently submerged if the vessel is travelling at speed.
- Assurance of the capability of safety systems is not provided.
- No clear process for assessing the risks from the options identified or the preferred option is described and although a risk matrix is used, no risk or acceptance criteria is presented.
- Risks that have been calculated have not been compared with any criteria.
- Thorough use of the outputs of the Hazid, has not be made ie some hazards ranked with a risk of C1 have been assessed in more depth but some have not.
- For both calculations the interpretation that potential loss of life (PLL) equates to percentage fatality probability is incorrect.
- For the calculation of the risk from ignition of the blowout, no time variable is in the equation, which is required.

- For the calculation of the loss of DP risk, the equation assumes a 30 day exposure period but the HSEMP suggests the vessel could be on location for eight weeks - almost double this period. Assuming an eight week exposure, and using the formula/assumptions suggested, gives an individual risk to personnel operating the deluge of 4.75 x 10^{-3}/yr or the campaign. This is considered very high and above the widely used industry limit of 1 x 10^{-3}/yr. Note this calculation assumes the same individuals are involved in deluge activities - there is no information provided regarding shift/work patterns
- There is no determination/evaluation of whether the risks are acceptable or not ie no comparison with established criteria.
- The risk assessment of the loss of position/collision MAE focus on a single consequence ie ignition of the gas cloud. Other consequences are identified in the HAZID i.e. collision with other vessels and are not assessed further. The potential for loss of stability due to collision or foundering is not considered in the Hazid or risk assessment and should be further addressed (note it may have been discounted as not credible in the Hazid but it was not recorded as such).
- The risk assessments do not consider personnel other than those operating the deluge monitors.
- A number of scenarios were modelled to simulate the heavier components or liquid dropout in the blowout. In the modelling, it is suggested that the heavy gas/mist or liquid drop-out dispersion poses more of a threat to the vessels as it is heavier than air and will extend down to sea level. The risks of this are not discussed in the main body of the report. In addition the flammability limits for heavy gases (the lower flammability limit for Hexane is 1.2% v/v) are very different to that of the mostly methane gas cloud and hence the gas detectors onboard the vessels would need to be calibrated to detect these flammable vapours - there is no evidence that the outputs of the modelling have been used in this way.
    - A key element to investigate further is that the heavy gas modelling conducted does not seem to simulate the situation correctly ie it appears that Cirrus' no momentum heavy gas model has been used. This would be more relevant for boil off of volatile components from a liquid pool rather than momentum release of heavy gases/atomised liquids.
    - Sensitivity cases have not been be explored with the inputs to the heavy gas dispersion including verifying the liquid drop-out assumption of 10%, as the modelling is sensitive to this assumption, the ground roughness assumed - again a sensitive parameter.
    - The location of the gas detectors are provided at the upper level of the vessel close to the air intakes. This will not detect gas at the back deck level where exposed personnel will be located.
- The ALARP proposition does not consider the benefits of other potential mitigating factors such as automating or remote operation of the deluge monitors in order to reduce the exposure of personnel on the back deck of the vessels.
- Details of the observation/ support vessel have yet to be provided. On p13 of 19 of the HAZID 'the support vessel in the field which could potentially nudge the vessel clear or provide an emergency tow'. Nudging the vessel introduces two additional potential ignition sources which have not been identified / addressed. These being associated with the support vessel itself and during the 'nudging' operation (metal to metal contact). Details of the emergency tow arrangements (rigging / hook-up / stand off and tow paths etc) have also not been described.

- Ignition Sources, all potential ignition sources have yet to be identified, including support vessel as detailed above. Fire pump diesel drive ignition sources have still not been identified. Fire pump drive local and remote shutdown systems have still not been described. Fire pump drive fire protection controls have not been described.
- No gas detectors are located in close proximity to the fire pump drives, in particular on the Nor Captain, where all the gas detectors are located in and around the accommodation structure – no protection / coverage of the aft working deck and diesel drives.
- The Safe Working Limits for the DP operations have not been defined.
- These limits, incorporating the DP FMEA events together with the project events have yet to be defined.
- DP 1 operating mode: The Havila Harmony Standing Instruction – Montara 2NM Zone Entry states: 'Change over to full Auto DP Mode will be made at a distance greater than 200m from the installation. At least two reference systems shall be selected into DP at this time.' Utilising two reference systems will mean the vessel is effectively operating in DP 1 mode.
- The DP risk analysis uses findings from the IMCA 115 DPVOA (1994). The IMCA publication of DP Station Keeping Incidents DPSI17 state that reference systems (25%) and human error (22%) are the main causes for reported DP incidents. Also, human error accounted for 46% of the main causes identified in DP undesirable events. DP procedural and reference system controls are not described in any detail.
- It is not clear if the vessel and fire team will be afforded deluge (water curtain) protection all times, when the vessel is in close proximity to the WHP. Will the deluge water curtain be deactivated / suspended when the water jets are required?
- The maximum water jet range for the pump spreads has not been defined. Confirmation that the maximum water jet range is established in conjunction with the activation of the deluge water curtain
- Appendix 3 contains no legend and title, or scale, to effectively describe drawings. Is red hatched area vessel deluge operating area?
- It appears a number of ventilation flaps will be closed, including: CO2 space and Emergency generator room. Risks for re-entry into the unventilated CO2 space need to be managed. The emergency generator is a safety critical element. If the emergency generator is taken out of service, alternate risk mitigation measures need to be described.