Montara Oil Spill Inquiry Analysis – Oil Spill Response

Report to WWF-Australia

February 2010

Prepared By:

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Executive Summary

This report was developed by Nuka Research and Planning Group, LLC under contract #122305 to provide WWF-Australia with analysis relevant to the Terms of Reference developed by the Montara Commission of Inquiry (the Inquiry) into the Uncontrolled Release of hydrocarbons at the Montara Wellhead Platform that commenced on 21 August 2009.

The objective of this report is to provide WWF-Australia with analysis of those Terms of Reference (TOR) that relate specifically to the adequacy of spill response and environmental impacts during the Montara Wellhead Platform Uncontrolled Release. The Terms of Reference related to the Adequacy of Response and Environmental Impacts are TOR 5 (Adequacy of Blowout Response), TOR 6 (Adequacy of Regulatory Obligations), and TOR 7 (Environmental Impacts Monitoring Activities).

Nuka Research and Planning Group, LLC has reviewed documentation available via the Montara Commission of Inquiry including all Submissions and supporting documentation, the Terms of Reference, and the Hearing Schedule and Policies established by the Commission of Inquiry. This report represents our observations and recommendations regarding the response to the Montara incident.

There are a few areas relating to the Adequacy of Response to the Uncontrolled Release (TOR 5) that should be further explored through the Inquiry process.

- Voluntary well ignition does not appear to have been considered as a well control measure, although this may have been a viable option, as it could have been implemented more quickly than relief well drilling.
- The time required to mobilize and transport the relief well drilling rig (3 weeks) could have been reduced if a rig had been locally available closer to the spill site.
- The Commission should review the operators' exploration plans and oil spill contingency plans to determine whether these plans made any specific commitments regarding blowout control resources or decision-making. If so, then this represents a need for stricter oversight.

There are a few areas relating to the Adequacy of Regulatory Obligations (TOR 6) that should be further explored through the Inquiry process.

- National well control standards and requirements for operators should be reviewed. Operators who have identified a relief well as a blowout control measure could be compelled through regulation or permit to have a rig on standby to drill relief wells, thus avoiding delays like the initial delay at Montara while the rig was mobilized from Indonesia to Singapore and finally to the spill site.
- The response techniques used during the response were primarily dispersants, and very little oil was mechanically recovered with boom and

skimmers. While there does not appear to have been any violation of national policy, the heavy reliance on dispersants is not entirely consistent with the stated national policy that mechanical recovery is the preferred method of clean-up. The National Plan policies on response technique selection should be reviewed to provide additional clarity about the use of dispersants vs. mechanical recovery for offshore spills.

- The National Plan policies on Dispersant Application should be re-considered regarding the potential for combinations of various dispersant chemicals to pose additional environmental toxicity. The national dispersant policy should also include some testing for environmental toxicity, particularly in instances where such a large volume of dispersants is applied over such a long period of time.
- Decisions about response technique selection were made without public input or review. The National Plan could be modified to include a better mechanism to allow either *ad hoc* or standing bodies of citizens and stakeholders to communicate their priorities and concerns to response decision-makers.
- Future oil and gas exploration operations should include stricter parameters for environmental monitoring and sampling, including requirements for baseline studies, and operators should have a clear understanding of the types of environmental monitoring studies that should be initiated and conducted during and after a release.

There are a few areas relating to the Adequacy of Environmental Monitoring (TOR 7) that should be further explored through the Inquiry process.

- The Environmental Monitoring Plan that establishes both the Operational and Scientific Monitoring Studies was developed through negotiation between PTTEPA and DEWHA. It is unclear the level to which this process may have compromised the scientific diligence of the monitoring studies. Overall, the Operational monitoring conducted to date and the Scientific Monitoring proposed is weak and vague and is not consistent with the Precautionary Principle.
- There appears to have been a significant lack of transparency in the design, implementation, and data reporting for many environmental monitoring activities. The DEWHA website contains only superficial information and initial reports from Operational Modeling. Methodologies for the Scientific Monitoring studies do not appear to be within the public domain.
- The fact that environmental monitoring was delayed and in many cases, superficial, results in a loss of valuable information that is needed to fully understand the extent of the spill's impacts. Absent this knowledge, it is nearly impossible to effectively remediate those impacts and restore injured species, habitats, and ecosystems.
- There appears to have been a lack of baseline data for the spill region.

Baseline studies should be conducted in all areas of oil and gas development.

- Given the heavy application of dispersants over a long duration, the lack of water quality sampling seems particularly negligent. There does not appear to have been any rigorous sampling below the dispersed slick for the purpose of quantifying the levels of dispersed oil, to ensure that they did not exceed the expected range.
- Information and data on spill trajectory and delineation was poorly captured and communicated. It is extremely difficult to find any plume or slick diagrams within the official incident documentation.
- Water quality sampling was extremely limited and conducted over a short duration, after a significant delay.
- Wildlife response activities appear to have been delayed, and wildlife impact surveys were not initiated until over a month after the spill was initiated.
- Fisheries sampling methodologies and results have not been communicated. It is unclear whether the sampling has been initiated, what type of sampling will be conducted nor the level of analysis. It is important that fisheries sampling continue long enough to assess any potential impacts to larval or embryonic fish.

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Introduction

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Objectives

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Progress

Nuka Research and Planning Group, LLC has reviewed documentation available via the Montara Commission of Inquiry[1] including all Submissions and supporting documentation, the Terms of Reference, and the Hearing Schedule and Policies established by the Commission of Inquiry. We have also reviewed related information and documentation available in the public domain, including the following:

- Web log entries at skytruth.org, which include satellite imagery from the release,[2]
- Reports by the Department of the Environment, Water, Heritage, and the Arts relating to the environmental monitoring studies conducted,[3]
- The Australian Marine Safety Authority (AMSA) website documenting the

[1] http://www.montarainquiry.gov.au/index.html

[2] http://blog.skytruth.org/search/label/Timor

[3] http://www.environment.gov.au/coasts/oilspill.html

Montara incident and response,[4]

- The Australian Marine Safety Authority National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances,[5] and
- The Australian Marine Oil Spill Centre (AMOSC) oil spill response resource inventory including their availability, location, and whether or not they were mobilized to the Montara response.[6]

It is important to recognize that this analysis was all developed based on review of written documentation. The authors were not firsthand participants in the Montara response, although we have firsthand experience in responding to a number of major U.S. oil spills. We have focused our analysis on issues related to spill response tactics and technologies, best practices, and recognized international standards for spill response. We have not provided comment on the TOR Inquiry issues that relate to agency performance or interactions among spill response agencies and organizations, as this is beyond our knowledge and experience base.

TOR 5: Adequacy of the Response to the Uncontrolled Release

Summary of the TOR and Focus of the Inquiry

In the Issues paper published by the Commission of Inquiry, it was noted that the Inquiry developed TOR 5 to gain an understanding of:

a. Why the owner/operator chose to tackle the Uncontrolled Release in the way that it did?

b. Whether there were alternative ways of stemming or stopping the release of hydrocarbons and why these were not pursued? To what extent was the decision influenced by safety, commercial, environmental, technical or other considerations?

c. Might decisions taken have been different in the event of a larger uncontrolled release of hydrocarbons, an alternative location, or if the consequences of that release had been thought to have been greater? How were decisions in that regard made?

d. The effectiveness of the relationship between the owner/operators and regulators and governments, and how this relationship may have impacted the adequacy of the response to the Uncontrolled Release by the owner/operators.

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4 http://www.amsa.gov.au/Marine_Environment_Protection/Major_Oil_Spills_in_Australia/Montara_Wellhead/index.asp

5 http://www.amsa.gov.au/Marine_Environment_Protection/National_plan/

6 http://www.aip.com.au/amosc/

Discussion of the Issues Raised in the DOR

Background

An Uncontrolled Release, or well blowout, occurs when an uncontrolled flow of gas or fluids is released to the surface when the oil and gas reservoir pressure exceeds the hydrostatic pressure of the drilling muds and fluids contained in the wellbore, releasing oil into the atmosphere. When a blowout occurs, well control is necessary to stop the flow of oil or gas. Several approaches exist: additional surface control measures (well capping); ignition of the well blowout; subsea control measures; and drilling a relief well.

Following the Uncontrolled Release, the operator of the Montara Platform, PTTEPAA, contracted with a well-recognized well control contractor (ALERT) to implement well control. ALERT's first recommendation was for equipment and vessels to be sourced and dispatched to provide deluging capability (dousing the well with seawater to reduce the ignition risk). The ALERT Team arrived in Perth (from Singapore) on August 22, 2009 and after a brief assessment recommended, in addition to the use of deluge, the implementation of well control activities to include surface capping and relief well operations. On that same day, the National Offshore Petroleum Safety Authority (NOPSA) issued Prohibition Notice #0222, prohibiting any personnel from working at the WHP or West Atlas facilities. This prohibition cancelled any opportunity for surface well capping, which requires that personnel work at or near the drill rig and platform facilities. During the period of September 7 – 11, NOPSA expressed concern regarding the safety of personnel involved in deluge operations, and these activities were subsequently curtailed by PTTEPAA, with a few firefighting personnel and resources retained near the blowout site.

Although PTTEPAA and ALERT began to implement the relief well plan immediately, response time was slowed due to the lack of availability of a drill rig to drill the relief well. Several nearby rigs were occupied and could not be released. The nearest available rig was the West Triton in Indonesia, which was transferred to Singapore to be prepared for the job. It was en route to the spill site on 27 August, 6 days after the spill began. It arrived at the spill site on 11 September, and began drilling on 14 September - 24 days after the start of the uncontrolled release. If a back-up drill rig had been required to be present in the area, this time could have been significantly reduced. Estimates of the oil release rate in this spill range from 64 to 480 tons per day, so each additional day of delay added a significant amount of oil to the environment.

Why the owner/operator chose to tackle the Uncontrolled Release in the way that it did?

PTTEPAA and ALERT considered several options for stemming the uncontrolled flow from the wellhead, initially recommending deluge followed by a combination of surface control measures and relief well drilling. Well ignition was not considered. A prohibition issued by NOPSA removed the possibility of surface well control activities, due to potential risks to personnel safety, leaving drilling a relief well as the only remaining option.

A relief well intercepts the subsurface wellbore of the out-of-control well. A relief well is often not the first or sole choice to control the well because of the time it takes to

mobilize a relief well rig into the area where the blowout is occurring. If a rig is on location or nearby, it may be possible to shut down drilling operations to aide in the blowout response. If there are no nearby rigs capable or willing to assist in the response operations, then it will take substantial time to move a second rig into the area. In the interim, other well control operations may be initiated, although this was not the case in the Montara release.

Once the relief well drilling rig is moved into the area, it still can take days to weeks to drill a well into the subsurface to a depth sufficient to intercept the wellbore that is actively blowing out. This was the case during the Montara release, where several unsuccessful attempts to drill a relief well occurred before they were successful. Once the wellbore is intercepted by the relief well, fluids are pumped into the well to control the blowout. Depending on the nature of the blowout these fluids may consistent of brine, drilling mud, or polymers; these fluids are often referred to as "kill fluids" because they serve to "kill" the well blowout. When the blowout is killed, the well may then be closed in.

The benefit of choosing to drill a relief well was that it presents the lowest safety risk to personnel. The drawback of relief well as well control is the amount of time required to drill the well. In the Montara incident, this was exacerbated by the long distance that the drill rig had to travel before it reached the spill site and by challenges in drilling the well. If a more proximate drilling rig had been made available to the incident, the 3-week mobilization timeframe may have been reduced; however, it is impossible to speculate as to whether another rig would have had quicker success in drilling a relief well.

The unanswered question in the Inquiry submissions is whether or not it would have been feasible to intentially ignite the well to control the blowout. It is obvious, since the platform did in fact catch fire during the incident, that there were sufficient flammable vapors present so support voluntary well ignition. PTTEPAA's submission does not discuss voluntary well ignition, therefore it is unclear whether this option was considered and dismissed, or whether it was not considered at all.

Voluntary well ignition is a rare occurrence, and certainly presents safety hazards. However, the major drawback from the perspective of many operators is the fact that voluntary well ignition results in significant financial losses, as the fire typically damages or destroys the well, rig, and/or platform. If voluntary well ignition was a viable option for the Montara Relase but was dismissed due to financial concerns, then the decision to use a relief well bears closer scrutiny. Otherwise, there do not appear to have been other viable options for well control during this incident. Most of the documentation available through the Inquiry suggests that personnel safety was the primary driver in most of the decision-making regarding well control, and this is consistent with international best practices.

Alternative ways of stemming or stopping the release of hydrocarbons

There are a few alternative approaches to drilling a relief well: surface control (well capping), subsea measures, and voluntary ignition. The Inquiry Submission by PTTEP on TOR #5 states that the well control measures that were considered for the Montara

incident were: deluge, well capping, and subsea options. Of these, deluge was conducted during the first few weeks of the response. Well capping and subsea options were both dismissed for various reasons, discussed below. Voluntary ignition was not considered and is not addressed in the PTTEP submission.

Capping Option

In order to cap and control a well, the well control specialist must be able to access the wellhead to either repair the blowout prevention system (BOP) or remove the defective BOP to control the well pressure. Therefore one of the first challenges, and often the most time consuming, is to remove the rig structure and wellhead debris from around the well, while it is actively blowing out hydrocarbons and drilling muds and at risk of possible explosion. In some cases, the wellhead can be exposed by clearing away the damaged rig or offshore platform components; however, in some cases rig removal may also be required.

Well capping requires specially trained personnel and specialized equipment to operate in these hazardous conditions. Compared to onshore well capping, controlling a blowout on an offshore platform presents additional challenges. The PTTEP submission summarizes the complications and challenges that would have been involved in capping the H1 Well. PTTEPAA ruled out the Capping Option for the following reasons: fire risks, risks of injuries or fatalitites, and NOPSA prohibition on personnel operations near the West Atlas and WHP.

Subsea Options

PTTEPAA considered two options to use sub-sea technology to control the blowout: fabricate a machine to crush the casing and block off the well flow; or cut the casing and cap it underwater. Both options were dismissed within 3 weeks of the release for several reasons, again linked mostly to safety. Cutting the casing was also considered to have a lower chance of successfully controlling the well than other options.

Voluntary Well Ignition

Voluntary Well ignition may be used during oil and gas blowouts, especially if there is a toxic component to the released hydrocarbons. Voluntary well ignition is differentiated from the spontaneous well ignition that may occur during a blowout because the operator chooses to ignite the well as a means of controlling the release.

The explosive limit of differing blowout flows varies with chemical composition. There is a minimum ratio of hydrocarbon vapor to air below which ignition will not occur; however, if hydrocarbons are released near the wellhead, gas will be present in the air, and some of the oil will flash evaporate, forming an aerosol of liquid droplets and vapor. Heavier hydrocarbon liquids that do not flash evaporate will continue to pool around well and release vapors. Hydrocarbon vapors will mix with air and form a combustible vapor cloud. Once this explosive vapor is exposed to an ignition source, combustion will start and a flame front will propagate through the flammable zone.

The high level of concern regarding unintended ignition during the Montara release, and

the fact that spontaneous ignition ultimately did occur, both indicate that there were sufficient ignitable vapors present to support voluntary well ignition. However, this option is not discussed in PTTEPAA's submission, therefore it appears that this option was not considered.

Significant personnel and property safety issues are associated with well ignition during an ongoing (uncontrolled) well blowout, and operators are often reluctant to voluntarily ignite a well since it may result in complete loss of the well, rig, platform or facility. From a spill impact perspective, voluntary well ignition may reduce the overall spill volume to water, although it creates air pollution in the form of the smoke plume.

If well ignition was identified by PTTEPAA in their oil spill contingency plans as a viable option for mitigating a well blowout, than it is important to raise the question as to why this response option was not considered. It is possible that safety considerations, which were a major component of the response decision-making, would have precluded this option entirely. However, there is not enough information in the publicly available documentation to understand whether or not well ignition was ever considered. It has been our observation in US offshore oil and gas operations that operators often identify voluntary well ignition as a viable response option in their contingency plans, but almost never apply this option, in large part because of the major financial losses they would suffer in the event of complete loss of the well, rig, and/or platform.

Decision-making regarding selection of well control options

Most of the documentation available through the Inquiry suggests that personnel safety was the primary driver in most of the decision-making regarding well control. The fact that there were such significant delays in mobilizing a rig to drill the relief well and then successfully drilling that well do not appear to be linked to any specific parameters of the blowout (location, size, etc.) although the distance that the relief drilling rig was required to travel to the spill site did play a part in the overall delays.

It is difficult to speculate as to whether a more proximate drilling rig might have been released to the Montara Release if it had occurred in a different location (i.e. closer to shore) or if the blowout volume had been more significant. Oil and gas exploration and production plans are developed based on the assumption that all available and necessary resources would be brought to bear to clean up a spill, regardless of its size or location. The problem with relief wells as a source control measure is that unless a drilling rig is situated nearby and the operator has immediate access to that rig, the operator must work through locating and then negotiating the release of an available drill rig, and that rig often must travel significant distances to the spill location.

A review of other major oil well blowouts worldwide show that the controlling the well is often a problematic and time-consuming prospect. For example, the largest blowout in history, the 1979 Ixtoc I incident in Mexico, took nine months for the well to be completely shut in, with two relief wells drilled. A 1987 natural gas well blowout in Cook Inlet, Alaska required nearly 8 months to control, again due to delays in mobilizing rigs and drilling relief wells.

Relationship between the owner/operators and regulators and governments and impacts on response adequacy

Based on a review of the available documentation, there do not appear to have been any major deficiencies or disconnects between the operators, AMSA, and AMOSC that impacted the adequacy of the response.

It is important to try to understand whether regulators held the operators to the appropriate standard with respect to the well control component of the response. According to the DEWHA Submission, Montara's oil spill contingency plan (OSCP) did not commit to a timeframe for controlling a well blowout. It is unclear, not having reviewed the OSCP firsthand, whether it committed to considering other types of control, such as voluntary ignition. If so, then the authorities may have had some justification to ask PTTEPA to consider voluntary ignition, which might have allowed the release to be controlled more quickly.

Conclusions and Recommendations on TOR 5

- The decision to drill a relief well was made on the basis of personnel safety considerations. Several other options were considered and dismissed for seemingly valid reasons. However, voluntary well ignition does not appear to have been considered.
- The amount of time that lapsed between the initiation of the release and the drilling of a relief well (10 weeks) is not atypical. It is not uncommon for relief well operations to require considerable time, which is why relief wells are not typically the first or sole choice to control the well.
- Delays in the relief well were caused both by the time required to mobilize and transport the rig (3 weeks) and the time required to successfully drill the well. The first timeframe could have been reduced if a rig had been locally available closer to the spill site.
- The Inquiry should clarify whether voluntary well ignition was considered as an alternative to a relief well. If it was not, the Commission should explore whether this option was dismissed due to financial considerations on the part of the operator.
- The Commission should review the operators' exploration plans and oil spill contingency plans to determine whether these plans made any specific commitments regarding blowout control resources or decision-making. If so, then this represents a need for stricter oversight.
- The Commission should consider whether the regulatory agencies had the authority to intervene in the process of securing a drilling rig in a more timely manner. If such authority was present but un-exercised, this may be cause for concern. If such authority does not exist, it might be an area to improve regulations.

TOR 6. Assess the Adequacy of Regulatory Obligations

Summary of the TOR and Focus of the Inquiry

The Commission has identified the following key legislation and regulations that appear to bear on the response to the Uncontrolled Release:

a. The National Marine Oil Spill Contingency Plan, managed by AMSA.

b. The *Offshore Petroleum and Greenhouse Gas Storage Act 2006*.

c. Schedule 3 to the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the *Petroleum (Submerged Lands) (Management of Safety on Offshore Facilities) Regulations 1996*.

d. The conditions of approval of the Montara Field Development under the EPBC Act.

The Commissioner wishes to understand the interplay between the actions of the owner/operator and the various regulators over the period and how this affected the options available to the owner/operator.

a. Whether the National Marine Oil Spill Contingency Plan adequately envisaged an uncontrolled release of hydrocarbons of the magnitude and duration of the Uncontrolled Release and in such a remote location in Commonwealth waters, or at least provided an adequate framework that could be adapted effectively to cope with differing events.

b. The extent to which the response should have been left to the owner/operator, or should have been subject in certain circumstances to direction by regulators. In other words, to what extent does the existing regulatory regime strike an appropriate balance between the commercial interests of the owner/operator compared with broader public interest considerations?

c. To what extent did the decisions by the owner/operators and regulators alike comprehend the overall picture, especially since there are a number of regulators, with differing responsibilities? What steps did regulators take to ensure that they had a shared understanding of emerging events? And to what extent did regulators work separately or jointly with the owner/operator to ensure an appropriate response? To what extent could other response mechanisms available within the regulatory regime have been used if the attempts to stop the Uncontrolled Release had continued to fail, and at what stage would these mechanisms have been implemented?

d. Whether the responses from the NT Department of Regional Development, Primary Industry, Fisheries and Resources; the Commonwealth Department of Resources, Energy and Tourism; the Commonwealth Department of the Environment, Water, Heritage and the Arts; NOPSA; and AMSA were appropriate.

e. Whether any steps taken by other regulatory agencies to respond to the incident, including the Western Australian Department of Fisheries and the Australian Fisheries Management Authority, were appropriate.

f. To what extent might the regulatory regime and specific obligations under the regulatory regime be improved upon in order to more effectively deal with future incidents?

The Inquiry also seeks to understand the extent of consultation undertaken by regulatory agencies and between those agencies and the owner/operator (or other parties) in determining the chosen course of action.

a. If the Uncontrolled Release had been of a greater magnitude, if the location of the incident had been different (including its proximity to other response equipment), or if the environmental or other consequences of the Uncontrolled Release had been greater, were there alternative avenues that regulators may have been able to pursue with the owner/operator (and other parties) to stem or plug the Uncontrolled Release?

b. Was the response appropriately determined between regulators and owner/operators, especially in view of the fact that public interest considerations may not necessarily align with commercial considerations or the specific interests of individual regulators?

c. Alternatively, if there were no other appropriate alternatives, what implications might this have for the way offshore petroleum developments should be regulated in the future? For example, might consideration need to be given to a more searching examination of what is proposed for offshore petroleum developments at the preapproval stage (covering environmental, safety or operational considerations)?

Discussion of the Issues Raised in the DOR

Adequacy of National Marine Oil Spill Contingency Plan to address worst case/blowout scenarios

The National Marine Contingency Plan plans for three levels of incidents, including Tier 3, or large spills of over 1,000 tons. The level of planning in place in Australia is on par with that of the US, Canada, and the EU. Australia's spill response program integrates multiple agencies and jurisdictions, and this is a common arrangement in oil spill response in nearly any nation. Large oil spills nearly always involve multiple agencies, organizations, and jurisdiction. There are a number of tools and agreements in place in Australia to facilitate these interactions. In our professional opinion, the fact that the Montara spill occurred and the delays in drilling the relief well were not directly related to any deficiencies in the National Marine Oil Spill Contingency Plan.

The response options utilized during the Montara Release favored chemical dispersants, which are a group of chemicals sprayed or applied onto oil slicks to accelerate the process of natural dispersion. They are usually used in oil spill response when it is desirable to reduce the amount of floating oil to minimize damage to shorelines, wildlife, and other sensitive resources. Chemical dispersants are most commonly used for offshore or

nearshore spill responses, often when conditions are too rough to conduct mechanical recovery. Chemical dispersants require a certain level of mixing energy to work effectively; they are least effective during calm conditions. The stated goal of dispersant use during the Montara Release was to reduce the likelihood of floating oil impacting on marine parks of Ashmore and Cartier Reefs.

AMSA's submission to the Inquiry states that the "window of opportunity" for dispersant use *"may be as little as only a few hours. If the conditions are favourable, as in this incident, the window of opportunity may be up to two days.*" However, no dispersant was sprayed until two days after the spill began. If this release had been a large instantaneous spill (as opposed to a continuing release), AMSA's resources may have been unable to effectively mobilize a dispersant response within the window of opportunity.

The first response equipment to arrive on the scene was a C-130 Hercules helicopter from Singapore, which sprayed dispersant from 2 days post spill to 4 days post spill. Single engine aircraft were judged to be more effective for the purpose, and they took over the dispersant response for the next nine days. After that, dispersant was sprayed from offshore support vessels with directions from aircraft, targeting concentrated patches of oil, and continuing operations over two months beyond the start of the spill. Six different dispersant chemicals were applied; all are approved under the National Plan, although it is unclear whether the National Plan Dispersants guidance ever envisioned a spill where multiple dispersants would be applied over time.

In deciding to use dispersants, AMSA determined that "the National Plan approved dispersants will likely have success on the unweathered fresh oil being released from the platform." AMSA conducted a Net Environmental Benefit Analysis (NEBA) to aid in dispersant use decision-making, and DEWHA provided input into this process regarding environmental impacts. DEWHA recommended using dispersants only on fresh oil slicks and in conjunction with mechanical collection, and away from coral habitat or major marine megafauna. NEBA is a common decision tool used in spill response, although it has been criticized in the context of dispersants because it does not always take into account the potential acute and long-term toxicity, particularly in a case such as Montara where the applications were ongoing for such a long duration.

Continuous dispersant operations is a plausible approach to an offshore blowout, where fresh oil is continuously being released. However, the decision to apply dispersants can have implications on the potential success of other response options, like on-water mechanical recovery. Once a slick is chemically dispersed, it will be much more difficult to corral, concentrate, and recover the remaining un-treated oil. And on-water recovery operations cannot be safely conducted in an area where aerial dispersant spraying is ongoing. Because the response favored dispersants so heavily, there may have been some lost opportunity for mechanical recovery.

Oil recovery vessels did not enter the area until 5 September, over two weeks from the start of the spill. This is not completely in alignment with the National Plan, which designates dispersants as a secondary response option, with mechanical recovery of oil the preferred option. It is important to understand the decision-making that led to a

dispersant-dominated response approach; however, there is little information in the Submissions that inform on this process. Because dispersants are a much less expensive and less labor-intensive response option than mechanical recovery, it is relevant to consider whether dispersants were emphasized to minimize cleanup costs. The Inquiry should attempt to determine what the driving factors were in relying on dispersants over other clean-up methods.

As discussed under TOR 7, the National Plan does not provide the same framework for environmental monitoring and natural resources damage assessment as, for example, the US system provides. Some of the delays in implementing monitoring and weaknesses in the monitoring programs (discussed under TOR 7) might be addressed in the future if the Australian requirements for spill environmental monitoring were strengthened to the level of the Natural Resources Damages Assessment (NRDA) requirements in the US under the Oil Pollution Act of 1990 and the US National Contingency Plan.

DEWHA's comments on TOR 7 also note that the environment plan developed by Montara "did not foresee the need for immediate or long term environmental monitoring in the event of an oil spill. While this would not have prevented or foreseen the management of risk, it would have acted as a contingency measure, providing baseline and long-term monitoring to assist in response operations and in identifying and addressing impacts. DEWHA intends to impose such a condition in future oil and gas approval decisions as part of its more conservative approach."

There are several facets of this incident and the response that may have broader planning/policy implications, some of which may relate to the National Plan and/or future operator oil spill plans or permits.

National requirements for relief well drilling could be implemented to require that operators have a rig on standby to drill relief wells, thus avoiding delays like the initial delay at Montara while the rig was mobilized from Indonesia to Singapore and finally to the spill site. The National Plan could be amended to provide additional authority to spill control agencies to intervene when there are delays in securing a drilling rig, if they do not currently hold that authority.

The Dispersant Guidelines under the National Plan includes a list of approved dispersants based on their estimated effectiveness from laboratory tests and their chemical composition/toxicity (again based on laboratory tests). Beyond the initial laboratory toxicity testing, there is no further requirement for field monitoring for toxicity impacts. In a case like the Montara, where there were several weeks' worth of ongoing dispersant applications and where 6 different dispersant chemicals were applied, this would have been at the very least an opportunity to collect field data on toxicity. It appears that there were some dispersant operations in the vicinity of shallower bank/reef areas, and it would have been particularly useful to monitor those areas, which are less appropriate for dispersant use than open water areas.

The National Plan would be improved by including requirements that toxicity testing/monitoring be conducted concurrent with any future dispersant applications. The National Plan should also specify whether it is appropriate for multiple dispersant

chemicals to be applied to the same spill. While it appears that the different chemicals were applied at different times during the spill, the National Plan does not appear to have considered whether there might be aggregate toxicity issues associated with using multiple chemicals, or other unforeseen consequences.

The National Plan could include stricter parameters for requiring responsible parties to initiate and fund environmental monitoring studies, and could provide guidance on acceptable sampling procedures and protocols. Operator plans could be required to include both baseline studies pre-operation and robust scientific monitoring if a release should occur.

Balance between operators/agencies/public interest. Was the public interest served?

The Commission appears to be interested in whether or not the balance between the operators and the regulatory agencies is adequate to serve the public interest, which in this case we presume to be minimizing the adverse impacts of the oil spill. A key factor in making this determination lies not in the interactions at the time of the incident, but in the governmental oversight that went on during the planning stages of this exploration operation. The operators are all required to develop oil spill contingency plans that outline how they would manage a blowout or other emergency. The oil spill contingency plan for Montara/West Atlas does not appear to be in the public domain. However, it would be worthwhile for the Commission to consider whether those plans set out any criteria for selection of well control techniques, and then assess whether those criteria were followed. The plan may also establish a timeline for drilling relief wells; in many areas of the US, operators are required to have a relief well drilled within 30 days. Did the operators set any time limit on drilling a relief well? If they did make some commitment in their plans that they did not meet in the real world, then the planning process (and regulatory oversight of industry planning) is not serving the public interest.

Also, the decision to favor dispersants over mechanical recovery resulted in a higher total volume of the oil remaining in the marine environment, in various states. Because dispersants were used so persistently during the response, very little of the oil released during the blowout was actually recovered. AMSA estimates are that approximately 433 tons of the total spill were recovered. This means that the rest of the crude oil has either evaporated (possibly leaving behind waxy residues that would persist in the environment), remained in the environment untreated, or has been chemically dispersed into the water column, where it may have other toxicity impacts. Dispersant and dispersed oil toxicity are issues associated with dispersant application, and these are discussed under TOR #7.

Perhaps the most important consideration here is whether or not there was any mechanism provided for stakeholder input into response decision-making. A review of the incident documentation does not appear to show that there was any level of stakeholder input or review. Comments from one of the fishing organizations (WAFIC Submission) states that they were denied opportunities for government consultation. Submission comments from the University of West Australia cite a lack of transparency in the communication of environmental monitoring and sampling data and results. There

are mechanisms in place in other nations such as Regional Stakeholder Committees in the US where either *ad hoc* or standing bodies of citizens and stakeholders are provided with a mechanism to communicate their priorities and concerns to response decision-makers.

As discussed under TOR 7, delays and shortfalls in environmental monitoring may make it difficult for the public and the government to fully understand the extent of the spill's impacts, which in turn will compromise the ability to remediate those impacts and restored injured species, habitats, and ecosystems.

Interplay/coordination between agencies and regulatory regimes

There does not appear to be any clear cut examples of where jurisdictional conflicts reduced the response effectiveness. Firsthand participants may provide better insight into this issue.

Whether the specific agency responses were appropriate.

As discussed above in the context of public interest, there are a few components of the spill response that bear further scrutiny: consideration of alternate well capping technologies (discussed in TOR 5); selection of spill response technologies (specifically the emphasis on dispersants over mechanical clean-up); environmental monitoring (discussed under TOR 7); and delays in mounting both an on-water response and environmental monitoring. Lack of adequate oversight or management by one or more of the involved agencies may have contributed to any or all of these situations.

Improvements to regulatory regimes for future incidents

In order to provide meaningful recommendations regarding improving regulatory regimes for future incidents, it is important to first get some consensus on what the successes and failures of the response were. Based on our review of the documentation, we believe the major response failures/challenges appear to have been:

- Delays in establishing well control;
- Insufficient on-water recovery operations;
- Relatively low amounts of oil recovered;
- Lack of dispersant toxicity monitoring; and
- Delays in initiating environmental monitoring and sampling programs.

There may be regulatory fixes for some of these issues. Stricter regulations and requirements for well capping/drilling relief wells may be effective. With most of the other response issues, the solution may not lie in new regulations, but in developing better mechanisms for ensuring that response decisions address stakeholder concerns and considerations. This might be done through development of stakeholder review committees or similar bodies.

If the location, magnitude, etc. of the spill had been different would the response authorities have had other options?

If the spill had occurred in closer proximity to major response resource centers, then obviously the mobilization and deployment of equipment, vessels, aircraft, and personnel

would have been quicker. This question seems to focus in again on whether there might have been a different well control solution if the spill scenario (location, size, severity) had been different. We can only assume that there has been some speculation that initial reports underestimating the release volume and/or the fact that the release happened so far offshore (and away from the public eye) somehow led the operators and regulators to somehow delay the response? This is beyond our knowledge base, but if the Inquiry shows that the response efforts were anything less than full-scale effort on the part of all parties, then there has been some negligence.

An uncontrolled well blowout is a worst case spill, regardless of whether it is releasing 60 or 400 tons a day. While the distance from shore certainly plays into decisions about what types of cleanup operations to conduct, it should not have any impact on the top priority, which would be to bring the blowout under control. If the platform had been located elsewhere, it may have been in closer proximity to another rig that could have drilled a relief well more quickly. The other well control factors discussed under TOR 5 were more safety related and would apply in most situations. The Inquiry should consider whether any effort was withheld early on in the response, for any reason, but particularly because of an underestimate of the severity of the release. It is equally important to ensure that PTTEP met any spill response obligations made in their oil spill or operational plans.

The key issue that the Commission seems to be concerned with here is source control; however, the parameters discussed (spill location, severity) typically relate more to decisions about spill cleanup tactics, sensitive area protection, and wildlife response than they do to source control. Response managers will typically utilize different response techniques, equipment, and tactics based on the spill location, trajectory, type of product, on-scene conditions, and size. Source control decisions may be influenced by the particular circumstances of the blowout, but regardless of the size of the blowout, the priority should be to bring it under control as quickly as possible. It is relevant for the Inquiry to consider whether voluntary ignition of the well might have provided a more effective source control option, as discussed under TOR 5. It is important to ensure that the decision-making on well control did not prioritize the well infrastructure over the potential for environmental harm.

Implications for future oil & gas exploration operations

There are a number of implications to future oil and gas explorations that relate back to prevention of future incidents, and these are being covered in the analysis conducted by Harvey Consulting, LLC.

From a response perspective, the major issue here is well control. The other spill response planning and policy considerations reach beyond oil and gas exploration to oil spills from other sources. However, the unique aspect of oil and gas exploration operations is the potential for a loss of well control and the need to be able to regain positive control of the well as quickly as possible. This can be achieved through enhanced regulations, more diligent oversight, and periodic field verification of well control technologies. No blowout prevention technology will be effective 100% of the time, but the government and operators should maximize their efforts to prevent blowouts,

because as the Montara illustrated, responding to them can be quite challenging.

As discussed under TOR 7, environmental monitoring was not an immediate priority during the response, and there was no clear understanding regarding PTTEPA's role or responsibility in conducting environmental monitoring. DHEWA's submission suggests that future exploration permits include the requirement that the operator commit to carrying out the required environmental monitoring and impacts studies in the event of a release.

A broader question is whether the risks clearly illustrated by the Montara Release outweigh the benefits of future exploration activities. In the US, offshore oil and gas development plans often cite the extremely low probability of a well blowout, and this low probability is typically factored into early environmental assessments of the potential impacts from development projects. The Montara Uncontrolled Release demonstrates that low probability is not zero probability. Any oil drilling operation can experience a blowout, and when it occurs, it may take weeks or months to control.

Conclusions and Recommendations on TOR 6

- The National Plan is consistent with other similar national plans in North America and the EU.
- National well control standards and requirements for operators should be reviewed. Operators who have identified a relief well as a blowout control measure could be compelled through regulation or permit to have a rig on standby to drill relief wells, thus avoiding delays like the initial delay at Montara while the rig was mobilized from Indonesia to Singapore and finally to the spill site.
- The response techniques used during the response were primarily dispersants, and very little oil was mechanically recovered with boom and skimmers. While there does not appear to have been any violation of national policy, the heavy reliance on dispersants is not entirely consistent with the stated national policy that mechanical recovery is the preferred method of clean-up. The Inquiry should consider the decision-making process that led to a dispersant-based response.
- The National Plan policies on response technique selection should be reviewed to provide additional clarity about the use of dispersants vs. mechanical recovery for offshore spills.
- The National Plan does not provide an equivalent framework for environmental monitoring as other nations. The US Natural Resource Damage Assessment requirements should be reviewed as a possible model.
- The National Plan policies on Dispersant Application should be re-considered regarding the potential for combinations of various dispersant chemicals to pose additional environmental toxicity. The national dispersant policy should also include some testing for environmental toxicity, particularly in instances where such a large volume of dispersants

are applied over such a long period of time.

- Decisions about response technique selection were made without public input or review. The National Plan could be modified to include a better mechanism to allow either *ad hoc* or standing bodies of citizens and stakeholders to communicate their priorities and concerns to response decision-makers.
- The major future implication of this incident, from a response perspective, relates to well control. It is possible to develop stricter parameters to ensure that future operations proceed with a more reliable mechanism for well control, such as a second drill rig on standby to drill a relief well.
- The Montara drilling plans did not adequately consider the need for environmental monitoring in the event of a spill. Future oil and gas exploration operations should include stricter parameters for environmental monitoring and sampling, including requirements for baseline studies, and operators should have a clear understanding of the types of environmental monitoring studies that should be initiated and conducted during and after a release.
- The most important implication of this incident is the fact that there is no blowout prevention technology that can be 100% effective; the risk of another catastrophic blowout cannot be removed unless oil and gas exploration is ceased.

TOR 7. Environmental Impacts and Monitoring Activities

Summary of the TOR and Focus of the Inquiry

The Inquiry also seeks submissions on the adequacy of the environmental response, including:

a. The adequacy of the "Monitoring Plan for the Montara Well Release Timor Sea as agreed between PTTEP Australasia and the Department of the Environment, Water, Heritage and the Arts, 9 October 2009" (the Monitoring Plan) (see http://www.environment.gov.au/coasts/oilspill.html). Relevant to this issue is the fact that:

   - The Monitoring Plan includes an Operational Monitoring Programme, with the monitoring to be undertaken by AMSA in accordance with the National Marine Oil Spill Contingency Plan.
   - The Monitoring Plan also incorporates a Scientific Monitoring Programme, which will be managed by the owner/operator. Specific studies under this Programme will require approval by the Department of the Environment, Water, Heritage and the Arts prior to initiation.

b. How effective was the Operational Monitoring Programme and what lessons have emerged?

c. Is the Scientific Monitoring Programme adequate; and are there worthwhile enhancements that could be made to it?

d. It is noted that the Department of the Environment, Water, Heritage and the Arts is required to approve study proposals under the Scientific Monitoring Programme, which will then be managed by the owner/operator. What role will the Department of the Environment, Water, Heritage and the Arts be taking in assessing or reviewing the veracity of the studies that are being commissioned? What will be the Department's role in determining how the studies might be modified or evolve as circumstances change over time? Will there be independent peer reviews of the studies?

e. What public reporting is envisaged to flow from the Operational and Scientific Monitoring Programmes?

f. What, if any, other action is envisaged following receipt of outcomes from the Operational and Scientific Monitoring Programmes?

Discussion of the Issues Raised in the DOR

An Environmental Monitoring Plan was published jointly by DEWHA and PTTEPA in October 2009, and it outlines the ongoing monitoring activities as well as future plans. The Environmental Monitoring Plan focuses on two areas: Operational and Scientific Monitoring. Operational Monitoring (Type I) which is focused on providing information that assist with executing the spill response in a manner that minimizes adverse environmental impacts. The Scientific Monitoring (Type II) involves data collection for short and long term monitoring of environmental impacts. The primary distinction between Type I and Type II monitoring (which may overlap in terms of methodologies and data collection/analysis) is that Type I monitoring provides rapid results that can be fed into the incident decision-making process to influence the response. Type II monitoring is less time-critical, and while the data may be used to determine overall spill impacts or assess damages, it is typically not considered in the context of day-to-day response operations. At a certain point in a large spill, Type I monitoring may become Type II monitoring, as the response winds down.

The Environmental Monitoring Plan called for five areas of Operational Monitoring:

- Monitoring of Oil Distribution and Marine/Coastal Resources
- Monitoring of Oil Character Fate and Effects
- Shoreline Assessment Ground Surveys
- Dispersant Efficacy and Fate of Dispersed Oil Monitoring
- Wildlife Impact Monitoring

The Scientific Monitoring Plan included seven proposed studies:

- Marine Megafauna Aerial Assessment Surveys
- Shoreline Ecological Assessment Aerial Surveys

- Assessment of Fish Catch for Presence of Oil
- Assessment of Effects on Timor Sea Fish and Fisheries
- Offshore Banks Assessment Survey
- Shoreline Ecological Ground Surveys
- Oil Fate and Effects Assessment

Assessment of Operational Monitoring

DEWHA's Submission states that their key concerns for operational monitoring were to determine the effect of the oil and response operations on water quality, habitats and wildlife through the following:

- profile of the oil, dispersants and oil-dispersant mixes in the water column (including vertical and horizontal distribution);
- fate of the oil, dispersants and oil-dispersant mixes; and
- timeframe in which impacts to wildlife, islands, reefs, shoals and coasts may occur.

As discussed below, the overall operational monitoring efforts appear to have been somewhat uneven and not well reported in the public domain. The Submission by the University of Western Australia characterized the monitoring efforts as "tardy and superficial." The biodiversity studies conducted by WWF Australia provided more in-depth information and analysis than the spill-sponsored monitoring reports. And the spill delineation done by skytruth.org using satellite imagery appears to have been more comprehensive and accurate than the slick delineation by AMSA. More timely and intensive operational monitoring should have been conducted and vigorously reported to the public. During the M/V Selendang Ayu oil spill in the US Aleutian Islands, water quality and fisheries sampling programs and results were quickly communicated out to the public; this type of transparency is critical during a large spill.[7]

Monitoring of Oil Distribution and Marine/Coastal Resources

The Monitoring of Oil Distribution and Marine and Coastal Resources has included trajectory modeling and aerial and on-water surveillance of the release. This study is a typical component of any spill response, where ongoing reconnaissance is conducted to delineate the slick, direct response resources, and monitor for shoreline or wildlife impacts. According to the DEWHA submission, results from this study were provided to DEWHA and used to target wildlife monitoring and response operations. This information should be provided for review by the Commission of Inquiry, particularly in light of the biodiversity studies conducted by WWF Australia, which showed significant concentrations of marine mammals, reptiles, and birds in the vicinity of oil slicks.

Interestingly, unlike major US oil spills in which the authors have participated, where GIS maps are frequently produced and published to summarize information about spill location and impacts, we could not readily locate such mapping for the Montara release.

[7] http://www.dec.state.ak.us/SPAR/PERP/RESPONSE/SUM_FY05/041207201/041207201_index.htm

The best source of spill imagery seems to come from the Skytruth web log. It is likely that this information was captured and mapped in some format, but it does not appear to be available for review. By comparison, during the M/V Selendang Ayu spill response in the US Aleutian Islands, daily maps were produced to show the results of aerial overflights.[8] The Inquiry should review the overflight maps that were produced during the incident, and should also compare that information to the Skytruth.org satellite imagery. There is a significant discrepancy between the estimated slick size offered by AMSA (6,000 km^2) as compared to the Skytruth estimate (10-25,000 km^2).

Monitoring of Oil Character Fate and Effects Study

This study incorporated the collection of oil samples from the sea and any impacted shoreline areas. DEWHA describes this study as including water and oil sampling and monitoring, but recognized that their efforts to determine the horizontal and vertical distribution of oil and oil dispersant mixes was hampered by contamination of samples. only four dispersant operations were monitored for oil-dispersant mix distribution and of those operations, three different dispersants were applied.

Of the small number (11 total) of water samples collected and analyzed, two were taken from beneath oil slicks, and one from beneath a slick of "white waxy droplets." One of the samples taken beneath an oil slick showed TPH 0.8-0.12 at all measured depths (1, 2, 3, 5m), while TPH was undetectable in all other samples. Another study looked at 6 sampling locations in the Timor Sea, with no hydrocarbons detected. A final study sampled locations on the Australian coast, with no hydrocarbons detected. This sampling data is of extremely limited utility because of the very small sample size. The DEWHA submission admits that "more timely provision of better quality information would have been beneficial in terms of assessing potential impacts on coral and fish spawning events that were occurring in the general vicinity of the Montara well."

While it is unclear why water quality sampling was so delayed and limited, and why so many of the samples were contaminated, it does seem clear from the DEWHA Submission that there was some disagreement between DEWHA and other response authorities regarding the importance of water quality monitoring. The Submission states, "DEWHA requested on numerous occasions that water quality monitoring, to assess the vertical and horizontal distribution of oil and oil/dispersant mixes, be undertaken. These requests were actioned in late September 2009 and results were received in early November 2009." The cause for these delays and shortcomings bear further consideration.

Independent sampling conducted by a local Senator (detailed in a Submission) identified dissolved hydrocarbons consistent with the gas chromatography "fingerprint" for Montara oil as far away as 112 km from the well location. Satellite imagery taken over the course of the release shows a significant plume from the spill, and a considerable spill area. This information suggests that additional whole water sampling from other locations might have provided more information about how quickly the oil was dispersing, and whether there were any areas where TPH concentrations posed a specific threat to local wildlife or sensitive areas.

[8] http://www.dec.state.ak.us/SPAR/PERP/RESPONSE/SUM_FY05/041207201/041207201_flt_index.htm

Shoreline Assessment Ground Surveys

The Environmental Monitoring Plan envisioned that surveys would be conducted to assess impacted shorelines or shorelines at risk, in order to characterize their "sensitivity and amenability to cleanup operations." According to the DEWHA submission, shoreline assessment surveys have been conducted at Hibernia Reef and Ashmore and Cartier Reserves, with results not yet received beyond the reporting of visual observations. Post-impact surveys are supposed to continue at Browse and Cartier Islands and at Ashmore Reef in early 2010.

A shoreline assessment study took place from 20 to 25 October (2 months after the uncontrolled release began), and sampled sediments on the islands of Ashmore Reef, Cartier Islet and Hibernia Reef. No oil was observed on the shorelines at that time. However observations made from the boat included many observations of oil sheens, some very near the reefs being studied, observations of dispersant as a white gloss of or white globs on the water, and observations of animals near or within the oily areas.

Monitoring of Dispersant Efficiency and Fate of Dispersed Oil

The DEWHA submission notes that this study, which was conceived as a separate endeavor under the original Environmental Monitoring Plan, was merged with the Monitoring of Oil Character and Fate Effects study. As discussed above, this study has yielded virtually no relevant information that could be used to assess the efficiency of dispersant applications nor the fate of dispersed oil.

A plan was in place early on to study the effectiveness of dispersants through fluorometry. However, the correlation between TPH and field fluorometry readings was poor, which is a common problem with fluorometry.[9] Visual cues were used instead to determine dispersant effectiveness, and to track the movement of oil. A quote from DEWHA's submission states "The water quality monitoring undertaken was of limited assistance to DEWHA in determining the horizontal and vertical distribution of oil and oil dispersant mixes because of the limited number of useable (i.e. not contaminated) samples collected. In particular, only four dispersant operations were monitored for oil-dispersant mix distribution and of those operations, three different dispersants were applied. More timely provision of better quality information would have been beneficial in terms of assessing potential impacts on coral and fish spawning events that were occurring in the general vicinity of the Montara well."

As a result, although the Monitoring Plan called for detailed plume modeling of the dispersed oil, no such plumes were ever charted because the information was not collected. More detailed monitoring and reporting of the concentration and location of oil in the water could have helped determine the impact of dispersant use, and the potential impacts of the dispersed oil on the Timor Sea ecosystem.

Perhaps the most significant gap in the dispersant monitoring was a lack of consideration for the potential toxicity impacts of the intense dispersant application. Chemically

[9] Flurometry provides a general measurement of the presence of substances that fluroesce, which includes oil, chemically dispersed oil, and a number of naturally occurring substances. It is extremely difficult to calibrate a fluorometer so that it provides quantitative measures.

dispersed oil has been demonstrated to be more toxic to some marine organisms than untreated oil. Researchers have also found that the undispersed oil residue that is left behind following a dispersant application may be more toxic than the untreated oil. The toxicity of chemically dispersed oil may be enhanced by exposure to sunlight, and chemical dispersion of oil has been shown to enhance oil uptake and bioaccumulation. Direct exposure to misapplied dispersant can also harm birds and mammals. None of the monitoring or sampling conducted to date has addressed any of these possibilities.

Wildlife Impact Monitoring

No wildlife response began until August 27, after a report of an oiled bird was received. DEWHA states they did not initiate wildlife response earlier than that because it was not within their authority. This was extremely reactive and not typical of best practices; usually, wildlife response is initiated immediately, before impacted animals are reported.

The first noted survey of environmental impacts was the rapid aerial survey of "mega fauna," defined as cetaceans, birds and marine reptiles (turtles and sea snakes) commissioned by DEWHA on 24 September 2009 - nearly five weeks after the spill began. Daily inspections of Ashmore Reef and its surrounds were conducted by Wildlife Response and Customs Officers. These inspections found 29 oil affected birds (19 deceased), and at least 2 oil affected sea snakes (deceased). Hydrocarbons from the Montara spill were observed on Ashmore Reef and Browse island shorelines. Biodiversity studies conducted by WWF Australia during roughly the same timeframe as the DEWHA surveys found widespread surface slicks, many in the vicinity of vulnerable wildlife populations. The fact that documented wildlife impacts appear low could be due to a lack of diligence in monitoring and sampling.

Aerial monitoring was the primary method for assessing megafauna impacts. The Inquiry should consider whether this method provided ample visibility to monitor potentially impacted species, based on the flight elevation and speed, and the records of observers (photographs, etc.). Is it possible that another methodology would have provided a more accurate view?

On 4 September, four fish of four different species were landed by a commercial fisherman and later analyzed for hydrocarbons. The report does not indicate the exact location where these fish were caught, or what prompted the analysis of these particular fish. It does not appear that the analysis was part of any monitoring plan, although the Scientific Monitoring Plan does indicate that additional fish samples would be taken. No other fish were sampled during the operational studies. These fish were frozen before analysis, preventing any analysis of their bile, which would have been a much more sensitive indicator of hydrocarbon impact. A program designed to capture and analyze bile from fish in a number of different locations around the spill as the release was occurring would have provided a much better indication of the spill's immediate impacts to fish stocks.

Overall, wildlife impact monitoring appears to have been rather cursory. Considering that this information was considered in assessing the “triggers” for long-term megafauna surveys, the Inquiry should consider whether the lack of documented impacts reflects a

lack of diligence in carrying out monitoring.

Scientific Monitoring Programs

According to the DEWHA Submission, the scientific monitoring programs identified in the Environmental Monitoring Plan are to be implemented based on certain "triggers" that are related to potential impacts to vulnerable species as identified in the EPBC Act Policy. Of the seven scientific monitoring programs proposed, five have been initiated, two have not been triggered.

The Environmental Monitoring Plan indicates that there was some level of peer review in the evaluation of the Scientific Monitoring Programs. The Inquiry should review those evaluations to help determine whether the long-term monitoring studies incorporate the peer review recommendations and comments. The Submission from the University of West Australia raises some serious concerns about the quality of the science proposed and conducted.

Marine Megafauna Aerial Assessment Surveys

These surveys are designed to assess any disturbance or harm to megafauna in the open sea. Marine megafauna aerial assessment surveys have not been initiated.

According to the Environmental Monitoring Plan, the trigger for these surveys was to be "harm or elevated risk or concern" to marine megafauna. It is interesting that this trigger was not activated, given the results of the WWF Australia biodiversity survey and even the DEWHA surveys. It is impossible to find impacts if you are not really looking for them. The EPBC Act Policy Statement (Attachment A to DEWHA Submission) repeatedly cites the Precautionary Principle as underlying the agency's policy. Yet, the opposite standard appears to have been applied in this case. The reliance on triggers to implement monitoring completely contradicts the precautionary principle, which would presume that there have been impacts and set out to try to gather as much information as possible on those impacts, rather than forestall monitoring based on extremely limited data. Perhaps if the operational monitoring had been more diligent, the triggers for long-term megafauna assessment would have been realized.

Shoreline Ecological Assessment Aerial Surveys

These studies are designed to assess any disturbance of harm to shoreline habitats including ecological character of the mainland shorelines and associated islands, Ashmore Reef and other reefs, Ramsar wetlands or other coastal areas that may be disturbed by oil discharge. According to the DEWHA Submission, this study has been triggered for a baseline survey of the Kimberley Coast between Darwin and Broome. The field work for this survey was conducted between 8 and 18 November 2009 and the report is expected in early 2010 (no report published as of 26 February 2010). Further activation of this study will depend on the results of operational monitoring study one.

Assessment of Fish Catch for Presence of Oil

These studies are designed to determine whether commercial fish have acquired a taint or other undesirable characteristics through contact with the spilt oil. The proposal for this

study was approved on 10 December 2009. Field work is expected to be conducted in January 2010, following postponement due to weather conditions in the region during December 2009. No further information on this study (including a methodology) is available. It is unclear what type of sampling will be conducted nor the level of analysis. The collection of live vs. frozen samples would facilitate a more meaningful level of analysis.

Assessment of Effects on Timor Sea Fish and Fisheries

This study is designed to assess any effects on fish species (all life stages) of impacted waters. This study has been triggered for during and post response assessments. Field work for assessments during the response was conducted between 6 and 19 November and the report is expected in early 2010 (no report available as of 26 February 2010).

No information is available regarding the methods to be used to assess the impacts to fish species, but in order to truly assess these impacts, long term studies are required. Oil has a more severe impact on embryonic and larval stages of fish than it has on adult individuals. In order to reveal the impacts to the fishery, young fish must be studied, and the study must be continued long enough to allow impacted larvae to grow into market-size adults. There has been some research done on hydrocarbon exposure to herring embryos which shows that even low levels of polycyclic aromatic hydrocarbon (PAH) exposure in embryonic fish can cause severe developmental problems.[10]

Offshore Banks Assessment Survey

This study is to determine whether there has been any impact of, or effect on, the marine banks in the region. Offshore banks assessment surveys have not been initiated. According to the Environmental Monitoring Plan, the trigger for these surveys was to be "harm or elevated risk or concern" to offshore banks.

The Inquiry should evaluate the determination that the offshore banks were not at any elevated risk for harm, particularly given the widespread application of dispersants and the potential for dispersants or dispersed oil to impact these areas.

Shoreline Ecological Ground Surveys

This study is designed to quantify any effects on coastal fauna or flora. As a priority, the study will look at resources and areas identified as sensitive. DEWHA expected to receive proposals for the implementation of these studies in December 2009. There is no further information available about these studies.

Oil Fate and Effects Assessment

This study is meant to build on the Operational Oil Character Fate and Effects study by investigating the distribution, weathering fates and effects of residual (post response) oil at sea. It encompasses an assessment of untreated oil and dispersant treated oil and oil in waters and sediments, to include trajectory and exposure assessments, analysis of sediment plume modeling, dispersant application and fate modeling, and water and biota

[10] The following link contains videos comparing the embryonic development of healthy herring embryos with those exposed to low levels of PAHs. http://www.research4d.org/projects/herring/herring.html

sampling. According to DEWHA, as of 22 December 2009, proposals were being reviewed.

It is important that the Fate and Effects Assessment addresses some of the discrepancies between spill documentation of the total footprint of the spill and information presented through other media, such as the Skytruth satellite imagery. The images at the link http://www.flickr.com/photos/skytruth/sets/72157622226354812/detail/ and the image at http://blog.skytruth.org/2010/02/timor-sea-drilling-spill-cumulative.html show an estimate of the extent of cumulative slicks from the blowout (with US State of Virginia shown for scale). According to this image, the spill footprint covered more than 57,000 km^2. This is a much greater area than is described in the spill documentation, and bears further research.

Conclusions and Recommendations on TOR 7

- The Environmental Monitoring Plan that establishes both the Operational and Scientific Monitoring Studies was developed through negotiation between PTTEPA and DEWHA. It is unclear the level to which this process may have compromised the scientific diligence of the monitoring studies. Overall, the Operational monitoring conducted to date and the Scientific Monitoring proposed is weak and vague. The Submission by the University of Western Australia points to potential conflicts of interest among the consultants hired for much of the monitoring and sampling work.
- There appears to have been a significant lack of transparency in the design, implementation, and data reporting for many environmental monitoring activities. The DEWHA website contains only superficial information and initial reports from Operational Modeling. Methodologies for the Scientific Monitoring studies do not appear to be within the public domain.
- The fact that environmental monitoring was delayed and in many cases, superficial, results in a loss of valuable information that is needed to may fully understand the extent of the spill's impacts. Absent this knowledge, it is nearly impossible to effectively remediate those impacts and restored injured species, habitats, and ecosystems.
- There appears to have been a lack of baseline data for the spill region. Baseline studies should be conducted in all areas of oil and gas development.
- Given the heavy application of dispersants over a long duration, the lack of water quality sampling seems particularly negligent. The AMSA Submission states that "no significant impact would be expected to species within the upper 5 metres of the water column given predicted levels of dispersed oil (30-50ppm). This compares with a regulated discharge level of 30ppm for produced water formations from facilities." However, no further analysis was done to verify that levels of dispersed oil stayed within these parameters. There does not appear to have been any rigorous sampling

below the dispersed slick for the purpose of quantifying the levels of dispersed oil, to ensure that they did not exceed the expected range.

- Information and data on spill trajectory and delineation was poorly captured and communicated. It is extremely difficult to find any plume or slick diagrams within the official incident documentation.
- Water quality sampling was extremely limited and conducted over a short duration, after a significant delay.
- Wildlife response activities appear to have been delayed, and wildlife impact surveys were not initiated until over a month after the spill was initiated. The scientific monitoring program indicates that no further megafauna or offshore bank assessments will occur because of a lack of triggers.
- Fisheries sampling methodologies and results have not been communicated. It is unclear whether the sampling has been initiated, what type of sampling will be conducted nor the level of analysis. The collection of live vs. frozen samples would facilitate a more meaningful level of analysis. It is also important that fisheries sampling continue long enough to assess any potential impacts to larval or embryonic fish.