

Assessment of report by Bioresarches Group Ltd (2014), titled “Benthic Sediment Quality Report - Astrolabe Reef”

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Executive Summary

This report presents the results from two surveys of the quality of sediment around the MV Rena and other sites in the Bay of Plenty. In 2012, samples of sediment were collected from five sites on Astrolabe Reef, and an additional 16 samples were collected at two distances from the Rena – eight at 500 metres from the Rena and eight at 1000 m from the Rena. Samples were analysed for aspects such as grain size and level of a range of contaminants. In 2013, different sites were sampled for levels of contaminants, including sites at Motiti Island and other islands in the Bay of Plenty. In 2013, sediment samples were collected at 500 m, 1000 m and 1500 m from the Rena, and bedrock was also collected from Astrolabe Reef. For all samples, the levels of the various contaminants were compared (where possible) against the relevant guidelines for assessing potential adverse effects on marine species.

Contaminants were detected in a number of samples (from both 2012 and 2013) and some exceeded the levels set by the relevant guidelines, indicating a potential for adverse effects on marine species. Some contaminants for which there is no defined sediment quality guideline (such as some antifouling compounds) were also detected. However, some substances, such as arsenic, are known to occur naturally in the marine environment and the authors state that some results may be due to naturally high levels of some substances in the Bay of Plenty. In addition, the authors note that high levels of some substances in some samples may have been due to items such as bolts and wiring found in the samples.

The authors of the report conclude that adverse effects on marine organisms are likely to be occurring in sediments adjacent to the wreck, but that adverse effects of contaminants on organisms at 500-1500 m from the wreck are unlikely to be occurring. However, they do state that levels of tributyltin exceeded effect threshold concentrations in sediment at 500 m and 1000 m from the wreck. They recommend that ongoing monitoring take place, utilising these data as a baseline.

While the raw data presented in this report will be useful for assessing the ongoing effects of the Rena on the Bay of Plenty marine environment, there are some flaws in the analysis of the data as presented and the objective of the report is also unclear. Given the analysis that has been undertaken for this report, we are unable to robustly assess the effects of the Rena on spatial or temporal patterns in sediment quality.

Specific Comments

While this report presents data from two surveys of the quality of sediments around the wreck of MV Rena, the purpose of the report is unclear. Is it to (a) present raw data for toxicant surveys as a baseline for future assessments; (b) determine the extent that toxicant levels are biologically relevant; and/or (c) conduct a formal analysis of toxicant levels to determine potential environmental effects from the grounding of the Rena? In any case, the report is inadequate. The scope of the report should state clearly what the objectives of the report are and if appropriate, present any predictions or hypotheses.

Our primary concern with this report is the lack of clarity around the purpose of the report and the lack of robust analysis and interpretation of the data presented in it.

Section 1.1 states that Astrolabe Reef and North Motiti Island were included in the analysis as potentially affected areas, with Tuhua and Rurima included as control sites, where it was expected there would be no influence from the Rena. This sets up the expectation that the purpose of the monitoring was to test for differences in toxicant levels between potentially affected areas and control areas where there was unlikely to be an effect. However, there was no formal analysis between potentially impacted and control sites, or at increasing differences from the Rena on Astrolabe reef (which the radial sampling design was presumably designed to achieve). Instead, the report focuses on reporting measured toxicant levels for each sample against ISQG guideline values. Although comparisons of toxicant levels against ISQG guidelines are useful for assessing biologically significant effects arising from the grounding of the Rena, formal analysis is lacking, and the presentation of biologically significant toxicant levels alone is not enough to assess the effects of the grounding (i.e., toxicant levels may have increased without being biologically relevant).

The presentation of summary data within the body of the report is inadequate because results for many of the sites are omitted, with no justification provided for these omissions. It is therefore difficult to evaluate spatial variation in toxicant levels as related to the grounding of the Rena. Some data are referred to in the text but are missing from the figures, for example, the report states (Section 1.4.2) that data for site C13 are shown in figure 9, but they are not. In addition, the presentation of the figures, with site numbers given, rather than named locations and distances, made it difficult to quickly interpret the data and discern any trends.

In our opinion, the analysis should have: (1) quantified spatial variation in toxicant levels between potentially impacted and control sites, with control sites providing an assessment of background variation in toxicant levels which can be compared against potentially impacted sites; and (2) determined if toxicant levels exceed ISQG guidelines and presented biologically significant effects. Although the report currently assesses breaches of ISQG guidelines (i.e., biologically relevant levels of toxicants), it does not provide enough detail to assess if toxicant levels at potentially impacted sites exceed variation in background toxicant levels. That is, toxicant levels may be unnaturally high due to the grounding of the RENA without exceeding ISQG guidelines. This is a serious limitation of the report and would require formal analysis to rectify.

Formal analyses of the differences in toxicant levels between each of the four sites (Astrolabe reef, Motiti Island, Tuhua and Rurima), and between the three zones on Astrolabe reef (500 m, 1000 m and 1500 m) should have been conducted and would have assisted with assessing

the effect of the Rena on sediment quality. We also consider that alternative ways of presenting these data would have been beneficial. For example, box and whisker plots with whiskers extending to extreme data points, multi-dimensional scaling plots, and bubble plots of the sample areas, with bubbles sized according to toxicant values. Each bubble could have been colour coded to indicate if toxicant levels exceed ISQG guidelines. Such a spatial representation of the data would have helped in assessing whether there are particular areas around the Rena that are potentially more impacted (e.g. sites in a particular direction from the wreck). Similar formal analyses should have been conducted between the 2012 and 2013 datasets for 500 m and 1000 m. We disagree with the statement in the discussion that these comparisons could not be made, although they should be interpreted with caution.

The captions for all tables and figures should have had further detail to aid in interpretation.

Some samples with high levels of contaminants are described as “isolated” because they contained material such as bolts; however, because a relatively small number of samples were collected, it remains unclear how isolated these high levels may be. For example, what is the prevalence of material such as bolts in the marine sediment and over what area do bolts leach contaminants? If one of the 16 sediment samples contained such an item, this suggests that over 6% of sediment may have high levels of contaminants. Additional information on sample collection and preparation would have been useful to aid in interpretation (e.g. did divers avoid collecting samples that contained such items; were items removed from samples collected using a grab; were some items more likely to be contained in samples than others?).

The authors conclude that adverse effects on organisms at 500-1500 m from the wreck are unlikely to be occurring. However, in the same paragraph they state that levels of TBT were detected above threshold concentrations at these distances (with the highest levels over 60 times the ISQG-high concentration), contradicting the earlier conclusion. The results in Figure 15 show that TBT was above the threshold concentration in a quarter of the samples (two of the eight) collected at 1000 m from the Rena in 2012.

Overall conclusion

This report, while providing data that will be useful for contributing to an ongoing assessment of the effects of the Rena on sediment quality, contains some flaws that should have been addressed for the data to be utilised for that purpose. As currently drafted, the objective of the report is unclear and the analysis and presentation of the data are inadequate to robustly assess the effect of the Rena on sediment quality.