



Environmental
Protection Authority
Te Mana Rauhi Taiao

Review Report

EPA staff's review of report titled "Antifouling Assessment: Proposal to Leave the Remains of the MV RENA on Astrolabe Reef"

Confidential and legally privileged

June 2014



Executive Summary

1. The EPA staff have reviewed a report by Safinah, on behalf of Lowndes Associates, titled Antifouling Assessment: Proposal to Leave the Remains of the MV RENA on Astrolabe Reef ("the Report").
2. The EPA staff consider that the Report lacks sufficient evidence to substantiate the theoretical rationales presented. We consider that the Report does not provide sufficiently thorough assessment of the risks that the antifouling paint on the hull of MV Rena ("the Rena") presents to the environment. The Report does not provide sufficient detail or robust scientific analysis to adequately assess the risks posed by the residual antifouling paints on the hull of the Rena. In its current form, the Report should not be used to inform a decision on the proposal to leave the wreck of the Rena in place on the Astrolabe Reef.
3. There are a number of crucial data gaps that must be filled in order to undertake a satisfactory assessment of the effects, and demonstrate that the proposal presents no risk, or is the option that presents the lowest level of environmental exposure to the toxins present on the Rena's hull. These data gaps are as follows:
 - A comprehensive and definitive painting/treatment history for the Rena has not been provided. This means that it is not possible to provide any certainty regarding the nature and quantity of the toxins present on the hull of the Rena. This uncertainty impacts on the level of certainty that can be placed on the statements made in the Report, many of which are unsubstantiated.
 - The Report lacks a complete risk assessment of the impacts of the toxins present: the focus is mainly on the pathways of exposure, but lacks hazard characterisation or assessment of the magnitude of effects.
 - The Report lacks supporting data to qualify the claims made in the Report, relying instead on theoretical assessment and apparently anecdotal information regarding the nature and likelihood of the possible effects associated with leaving the Rena in place on the reef.
 - No information has been provided in the Report relating to the effects associated with alternative options (such as dismantling operations) without which comparative assessment of the level of risk cannot be made. The EPA staff note that Volume 3 of the resource consent application provides descriptions of three alternatives for dealing with the wreck. However, the EPA staff do not consider that these alternatives are supported by information that allows for the relative risks associated with each to be adequately assessed.
4. The EPA staff note that, whilst the EPA staff have not undertaken a thorough review of the entire application, it appears that significant aspects of the environmental risk assessment have not been considered anywhere in the application. This raises concerns over the level of evaluation carried out.
5. While much of the rationale provided appears sound, the EPA staff are not able to support or oppose the conclusions reached in the Report in the absence of sufficient data or evidence. The EPA staff consider that a detailed risk assessment is required in order to draw conclusions on the impact of the toxins in the antifouling paint (AFP) coatings on the hull of the Rena, and would need to review that assessment in order to form an opinion on whether leaving the Rena on the reef is the best outcome in terms of the impacts of the antifouling paint biocides on the environment.

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Summary of the Report:

6. On behalf of Lowndes Associates, Safinah have provided a report titled Antifouling Assessment: Proposal to Leave the Remains of the MV RENA on Astrolabe Reef ("the Report"), dated 28 May 2014. The Report forms part of the documentation that accompanies the application for resource consent to leave the wreck of the Rena on the Astrolabe Reef, focusing on the potential for the antifouling coatings on the hull of the wreck to cause environmental impacts
7. The Report identifies four toxins that may be present in the surface coatings on the hull of the Rena, and discusses the risks associated with those toxins should the wreck be left indefinitely on the reef. The identified toxins are: zinc, diuron, copper and tributyl tin (TBT).
8. The Report concludes that the potential effects from the proposal to leave the Rena in place indefinitely are minor. Accordingly, no mitigation measures are recommended in the Report, on the basis that operations to remove the wreck are more likely to release biocides from the hull's surface compared to leaving the wreck *in situ*.

EPA staff opinion

Summary of EPA review

9. The EPA staff have reviewed the Report. The EPA staff consider that the Report lacks sufficient evidence to substantiate the theoretical rationales it presents. We consider that the Report does not provide a sufficiently thorough assessment of the risks that the antifouling paint on the hull of the Rena presents to the environment. The Report does not provide sufficient detail or robust scientific analysis to adequately assess the risks posed by the residual antifouling paints on the hull of the Rena. In its current form, the Report should not be used to inform a decision on the proposal to leave the wreck of the Rena in place on the Astrolabe Reef.
10. There are a number of crucial data gaps that are required to be filled in order to undertake a satisfactory assessment of the effects, and demonstrate that the proposal presents no risk, or is the alternative that presents the lowest level of exposure to the toxins present on the Rena's hull. These data gaps are as follows:
 - The complete painting/treatment history for the Rena has not been provided. This means that it is not possible to provide any certainty regarding the nature and quantity of the toxins present on the hull of the Rena. This uncertainty impacts on the level of confidence that can be placed on the statements made in the Report, many of which are unsubstantiated.
 - The Report lacks a complete risk assessment of the impacts of the toxins present: the focus is mainly on the pathways of exposure, but lacks hazard characterisation or assessment of the magnitude of effects.

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- The Report lacks supporting data to qualify the claims made in the Report, relying instead on theoretical assessment and apparently anecdotal information regarding the nature and likelihood of the possible effects associated with leaving the Rena in place on the reef indefinitely.
 - No substantive information has been provided relating to the effects associated with alternative options (such as dismantling operations), without which comparative assessment of the level of risk cannot be made.
11. While the EPA staff consider that much of the rationale provided appears sound, the EPA staff are not able to support or oppose the conclusions reached in the Report in the absence of sufficient data or evidence. The EPA staff consider that a detailed risk assessment is required in order to draw conclusions on the impact of the toxins in the antifouling paint (AFP) coatings on the hull of the Rena, and would need to review that assessment in order to form an opinion on whether leaving the Rena on the reef is the best outcome in terms of the impacts of the antifouling paint biocides on the environment.
12. The EPA staff note that other AFP substances have been identified in other reports (i.e. isoproturon, irgarol) supporting the application. However, it is not clear whether the analysis looked for other AFP substances. If not, it is possible that other AFP contaminants may be present but not reported.

Removal of the Rena from the Astrolabe Reef

13. The purpose of the Report is to provide an assessment of the effects that the AFP coatings on the Rena might have if the Rena wreck is allowed to remain on the Astrolabe Reef. However, the alternative option of dismantling and removal of the wreck has not been assessed. The Report states that there is greater adverse effect likely to occur through the removal operation generating environmental exposure to the AFP toxins. However, this position is not substantiated.
14. It is possible that removal operations could result in short-term release of paint residues into the environment, but once removed the release of further contaminants would cease. However, this would need to be weighed up against the long-term release of toxins from the Rena if it was to remain on the Astrolabe Reef. The EPA staff do not consider that there is sufficient information in the Report to say which of these options would be preferable in terms of the environmental impacts associated with AFP toxins.

History of the hull coating regime on the MV Rena

15. The full coating history for the Rena has not been provided in the Report. Therefore, much of the determination of the effects of the toxins is based on estimations of toxin levels. However, it is unclear how much certainty can be placed on the values determined, as these values cannot be verified. No explanation is given for the lack of a full coating history. This history is required in order to complete a full risk assessment of the proposal.

Lack of hazard assessment of effects of antifouling toxins

16. The Report does not attempt to determine the level of chronic effects arising from the antifouling paints (AFPs). The chronic exposure effects can be an issue, particularly for TBT, and the effects can be magnified through the food chain even if the levels of toxin release from the hull are very low. The EPA staff would expect to see a comparison of the level of anticipated exposure to known concentrations that present no adverse effects, to determine whether the expected emission rates are likely to exceed levels of concern.
17. The Report lacks a complete risk assessment of the impacts of the toxins present: the focus is mainly on the pathways of exposure, but lacks hazard characterisation or assessment of the magnitude of effects.

Pathway for toxin release

18. The Report provides a reasonable, theoretical rationale regarding the expected mechanism for release of toxins from the hull coatings. However, no data is provided to justify the conclusions reached. The EPA staff would expect to see evidence before reaching any conclusion.
19. The Report states that the hull of the Rena has been treated with self-polishing paint and describes the properties of self-polishing antifouling paints. The Report concludes that the toxins contained in the surface coatings at the leach layer will be exhausted, so that leaching is not expected to present an on-going issue. While the EPA staff consider that this rationale appears to be reasonable, it is not substantiated with any relevant data from the Rena, or an actual history of the paint treatments applied to the hull.
20. If a depleted leach layer is removed, then that would provide a pathway for newly-exposed paint to leach toxins. The Report does not include an evidence-based assessment of the mechanisms which may give rise to removal of the leach layer or paint layers, such as water flows, or movement of wreckage causing scouring of the hull surface. It is conceivable that the depleted leach layer will be eroded over time, providing an opportunity for release of further toxin from the hull paint. The Report does not provide an assessment of the risks associated with the removal of external paint layers.
21. The EPA staff note, however, that the Report assumes that the paint is no longer effective as an antifouling paint, and, as such, will not give rise to any adverse effects. The EPA staff do not consider that this has been demonstrated, particularly given the lack of assessment of the chronic effects of AFPs.
22. Corrosion of the wreck and the impact that this may have on the release of AFP toxins has not been assessed. This could be a relevant mechanism for future release of toxins into the environment and should be assessed in order to determine whether corrosion of the hull is of significance.
23. The Report indicates that the effects arising from toxin release from the AFP coatings will be readily dissipated because of the tidal currents around the area of the Rena. No data has been provided to substantiate this claim.

24. The Report indicates that the greatest risk in terms of on-going leaching of AFP toxin will arise from flaking of the paint from the hull, providing fresh surfaces for which leaching can occur. However, the Report does not provide any detail on the possible causes and likelihood of this pathway as a mechanism for exposure.

Existing colonisation of Rena hull

25. The Report places significant weight on the fact that the hull is already colonised to some degree and concludes that this indicates that the level of toxins being released must be sufficiently low as to not present an environmental concern.
26. However, the Report does not specify the diversity of the flora and fauna that has colonised the hull: whether the colonisation is from a typical range of organisms, or from a limited number of resistant organisms. This is of particular importance when considering the chronic effects of exposure which may not be immediately observable but accumulate over time. Additionally, there is no information provided relating to the extent of (or lack of) existing fouling at the time of the grounding.
27. While it may be reasonable to presume that the level of existing fouling could be low (due to the commercial requirements of operating the vessel), there is no information provided that allows the level of colonisation to be determined. Without more details, the relevance of the degree of colonisation of the Rena is unclear and requires further information to understand the level of effect of the paint on the hull of the Rena.

Identification of toxins of significance

28. The Report does not provide sufficient data about how the relevant toxins (zinc, copper, diuron and tributyltin (TBT)) were identified. In order to confirm the full list of toxins of interest present on the Rena, the Report needs to provide additional information regarding the nature of the sampling and analysis that was undertaken. The EPA staff would be concerned if the analysis was restricted to look only for the four identified toxins, rather than looking at the broader group of AFP biocides.
29. The EPA staff have not been provided with the analysis reports. The EPA staff would expect greater details to be included in the Report regarding the detection and quantification limits for the analysis undertaken. This is relevant because the concentrations of the contaminants is likely to be low and require appropriate detection levels to ensure that a 'nil' detection is due to a lack of contaminant in the sample, rather than the minimum detection level being set too high.
30. In addition to the Report, the EPA staff note that two of the other supporting reports make reference to contaminants, including AFPs. These indicate that other AFP actives (not detailed in the Report) have been analysed for, and contain chemicals not identified in the Report. However, it is not clear whether the list of AFP active ingredients analysed for covered all possible AFP substances. This provides additional uncertainty regarding whether the conclusion in the Report that only copper and TBT are the

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only contaminants of significance are valid, as it is possible that other AFP contaminants may be present but not analysed for.

Speciation of metal toxins

31. The environmental fate of metals can vary because, instead of degrading, they are transformed into other forms. The nature of those other forms depends on the physico-chemical properties of the substance and environmental factors of the location. This is a process known as "speciation". The EPA staff note that the Report does not address the issue of speciation of metals, and largely looks at the effect of the toxins by virtue of their metallic component.
32. Different forms of zinc and copper toxins can have significantly different toxicities, and different bioavailabilities (i.e. how 'available' the toxin is to biological organisms). It is these toxicities and bioavailabilities which enable a full risk assessment of the impacts of the metallic-based biocides. This will also be relevant for the tin toxins, generated from TBT.
33. An assessment of this effect, including speciation modelling, does not appear to have been undertaken and is required to determine the precise nature of the toxins of concern. In order to undertake this assessment, details of the hull coating history is required.
34. The EPA staff consider that assessment of speciation is necessary to accurately describe the fate of these contaminants in the conditions of the location of the wreck and in the wider environment. The EPA staff do not consider that this concern has been addressed in the application, or any of the supporting reports.

Zinc

35. Under the HSNO Classification criteria, zinc and zinc oxide are classified as 9.1A (very ecotoxic in the aquatic environment). This classification represents the highest classification of aquatic ecotoxicity.
36. Zinc metal and zinc oxide have been identified in the Report as being present in sediment samples. The sources identified are in the hull coating, and sacrificial anodes (the Report suggests that these would have been used on the Rena, but does not confirm that this was the case or provide any further details to determine the impact on the levels of zinc in the environment). Sacrificial anodes have a certain lifetime, and their purpose is to corrode in preference to the vessel's hull. Once these anodes are depleted, it is likely that the rate of corrosion of the ship's hull will increase, with potential to release further quantities of the toxins from the paint layers.
37. The EPA staff agree that the presence of zinc in the environment cannot be solely attributed to the paint on the ship's hull. However, there is no attempt to quantify the effects arising from zinc contamination from other mechanisms of release.

Diuron

38. Under the HSNO Classification criteria, diuron is classified as 9.1A (very ecotoxic to the aquatic environment) on the basis of its toxicity to algae.
39. The Report states that the biocide, diuron, is thought to be in the outer paint layer, and therefore prone to leaching. The Report suggests that the leach layer will be depleted of diuron, but the leach layer has

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not been polished off. The Report theorises that the leach layer is essentially acting as a barrier layer, preventing leaching of diuron from the paint below the leach layer. No data is provided to substantiate these claims in the state of the paint coatings on the hull of the Rena.

40. The Report does not provide details on the quantities of diuron remaining on the hull of the boat, nor does it include a thorough risk assessment of the effects of the remaining diuron.
41. Flaking of paint, and exposure of undepleted paint layers are likely to result in increases in the quantities of diuron being released into the environment. The Report does not provide sufficient evidence that the level of impact of this toxin has been adequately assessed.

Copper

42. Under the HSNO Classification criteria, copper¹ is classified as 9.1A (very ecotoxic in the aquatic environment). This classification represents the highest classification of aquatic ecotoxicity.
43. It is not clear from the Report the complete history and nature of the hull paints used on the Rena. A theoretical conclusion is drawn regarding the nature of the AFP coatings, stating that a coating would be selected on the basis of its intended performance. Whilst this is a reasonable assumption to make, the lack of data on the nature of the AFP coatings make a definitive conclusion very difficult to reach.
44. Given the lack of comprehensive information presented for the paint coating history of the Rena, it is not possible for the EPA staff to confirm (or otherwise) the validity of the assumptions made in the Report in regards to the quantity of copper remaining on the Rena's hull.

Tributyltin (TBT)

45. Under the HSNO Classification criteria, tributyltin compounds are classified as 9.1A (very ecotoxic to the aquatic environment).
46. The Report notes that TBT has been banned from use on large vessels, and existing paint coatings containing TBT were required to be either removed from the hulls of vessels, or encapsulated by use of a sealer coating. No definitive painting history is provided to determine how and when this obligation was met. Also, no information has been provided on the properties of the encapsulation layer. The EPA staff are not able to provide a view on the long-term performance of this encapsulation and whether this will be sufficient to retain the TBT indefinitely.
47. No history of the hull treatment has been provided to confirm whether the Report's statements regarding the low level of TBT on the bow section is correct. For instance, it could be that more paint was applied to higher wear areas, such as the bow, so there could be greater levels of TBT present than detailed in the Report. Details of the precise painting regime undertaken or analysis of paint samples would be required to be able assess this statement.
48. The Report states that normal exposure is expected to result from contaminant release from the edges of paint coatings, rather than the face of the paint coating. This would seem to be a logical assumption; however, no information has been provided to substantiate this position.

¹ Copper can be present in different forms in AFPs, including copper metal, copper (I) oxide, copper thiocyanate, and are classified as 9.1A.

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49. The Report presents theoretical TBT concentrations in Table 5. Based on the values provided, the concentrations of TBT would exceed the LC50² values for many of the scenarios presented in the Report. The EPA note that the Report is conservative in presuming that all of the TBT would be released at the same time. However, the EPA staff restate their concerns regarding the effects of bioaccumulation and metal speciation, and consider that these are factors that have not been taken into account in assessment of the impacts of TBT.
50. The EPA staff note that the sediment sampling results between different supporting reports appear inconsistent. Whilst the EPA staff have not thoroughly reviewed the other reports, different figures for positive tests for TBT are presented (2 of 29 samples in the Report; *c.f.* 14 of 18 samples in the Sediment Quality report).

² LC50 is a standard toxicological measurement and is the concentration of a substance that can be expected to cause death in 50 percent of subject organisms.