

Rio Tinto Mine Water Remediation Challenge Questions and Answers from the Q&A Webinar

General

1. What is the role of Isle Utilities - are you a broker or a project partner?

Isle's role in the mine water remediation program is to support the Rio Tinto Closure R&D team in delivering this project. Isle is a global technology, innovation and management consulting business. Our goal is to bring together leading developers of sustainable water treatment solutions and industrial end users. The aim of this is to facilitate the accelerated development and adoption of these new solutions. We are independent - we are not affiliated with any technology companies. We make recommendations in the best interests of the industry end-users.

Areas of Interest

2. Rio Tinto has listed 5 Areas of Interest (Aoi)– when will the challenges for the other topics be opened?

While we have identified these areas of interest, not all of them are equally suited to a challenge such as this selective challenge. However we do encourage submissions to take these other AOIs into account when preparing their submission for this challenge. There will be at least 1 other challenge in the future related to MIW treatment, but the timing for this challenge has not been finalised yet.

3. Aside from the selective, which other Aois are critical, and of interest to you?

The Aoi's are all interconnected, and they are all important. The selective Aoi is a high priority for Rio Tinto and lends itself the most easily to this type of crowdsourcing campaign, however, we are considering opening other Aoi's to this type of challenge. The timeframes for this have not yet been discussed, but we may open up discussions around this towards the end of the year.

4. If my project does not fit into the Selective category, should I submit a proposal?

A good question – we are always on the lookout for good ideas and technologies that may support our goals. If you have a topic that does not fit within this selective challenge, we do have an open submission area on the Pioneer Portal (situated below the sections for the active challenges). I would encourage anyone to submit an idea here and just note that it is a MIW treatment related idea/technology. These submissions do come to the team, they do not get lost.

5. Do I need to be working directly with selective recovery from the water phase or can I propose a project that aims to selectively recover the target contaminants from by-products of existing water treatment processes?

No – you don't need to be aiming to selectively recover from the water phase. If you have a technology that can selectively recover targeted resources from a water treatment by-product, this still has value and would certainly fulfil the criteria for being a selective technology. We realise this is not likely to be a one-step solution. For example, we'd love to know if you can recover precipitate and then extract

the metals of interest from precipitate. This would produce the same result, just using a different pathway.

6. Do solutions need to be general or are niche solutions OK?

Niche solutions are certainly OK to submit. We envisage that we will need to employ a multi-step process to achieve our MIW treatment goals, and there is certainly space for niche solutions to play an important role in providing flexibility to the MIW solutions Rio Tinto has on hand to apply at different sites that have different demands.

7. Can we propose different projects?

You can submit more than one solution idea and doing so will not impact your chances of being selected.

8. What is the total budget for this challenge, and how many projects will be shortlisted?

We would like to consider solutions across the full range of TRL's, but we do not have an infinite budget to do this. We are committed to this programme, and we have secured budget to fund and/or cost-share individual projects from US\$50,000 up to US\$2 million.

We are approaching this process with the goal of identifying projects and partnerships that will add value to our work in Closure. Therefore, we have not set a defined number of projects/partnerships we will be supporting but taking on those we feel have merit and fit the objectives we have for our R&D pipeline. This could be a mix of small and large projects. At this stage, we're keeping an open mind.

Technology Readiness Levels

9. My technology concept is early/late stage TRL – can I still deliver a submission?

This challenge is a pathway to populate a long-term R&D pipeline in the water treatment space at Rio Tinto. As such, we are looking for technologies that fit all TRL levels from TRL 1 through to TRL 9 and will be taking this into account in our assessment process, so feel free to submit your solution, regardless of the maturity of your technology. We have challenges that need solutions in both the short and long term, and we need projects at all levels to build a sustainable pipeline. There is a lot of excellent work happening at research centres, universities and organisations across the world, and we want to know about, and if possible, be involved in supporting this work. Equally, if you have a technology that you feel is at technology readiness level 9, then we'd be happy to hear about the benefits you could provide our sites in the short term.

10. If the submitted proposal has low TRL, do you have an expectation for the TRL level by the end of the project?

This is not defined; however, we wouldn't expect a technology to go through more than two stages of development. In other words, we don't expect projects to be aiming to move from lab to commercial implementation within the projects being supported in this program.

11. Can you elaborate on what you mean by "the project should not include more than two stages of development"? Is this related to the technology readiness level?

Yes. Proposals should not expect to go from TRL 1 through to TRL9. The stages are:

- Proof of Concept: Advancing a technology currently in TRL2 or TRL3 to TRL4
- Prototype/Pilot: Advancing a technology currently in TRL4 to TRL6
- Demonstration: Advancing a technology currently in TRL 6 to TRL7 or TRL8 (also from TRL7 to TRL8)

So, for example, a project could go from proof of concept to pilot, but it should not go from proof of concept to demonstration.

12. Technologies used to remove different contaminants sequentially in modular systems may be in different levels of technology readiness. Can we have different TRLs within the technological process?

Yes, we recognise that these waters are complex, and there won't be once single solution. These complex waters will probably need a few different treatments working together to try and overcome the challenges we have with them.

13. As for the pilot scale, where do you envision to have the pilot scale testing? Could that be performed through the collaboration with Rio Tinto?

Yes, we can do this. The goal of the challenge is to find out what companies need to advance their technology and how Rio Tinto can best support this advancement.

Site Specific Details – Location, Flow, Contaminants**14. Are you only looking to work on sites that are part of the 92 upcoming closures? Or would any site previously closed be considered for the implementation of a proposed technology?**

For clarification, we already have 92 closed legacy sites, and within the next 10 to 15 years, more sites will be closing. We are looking for technology solutions for both already closed and future closure sites.

15. What is the geographic coverage of the sites you're looking to treat?

We have 92 legacy sites globally. However, the majority of sites are located in North America, Europe and Australia.

16. What is Rio Tinto's most challenging site?

They all are challenging for different reasons. Some are more challenging than others, but we cannot pinpoint one single site. At one site, it could be the concentration of constituents while at another it could be the volume of flow. Since this is an R&D project, we're also looking towards the future and the challenges this will present more sites transitioning to closure and potential changes in treatment requirements.

17. Do you have preferred locations for a pilot project?

No, we're open minded to location. The location for a pilot project (if that's what you're looking to do) depends on the technology you have and the water you're targeting, and you could go to several sites.

18. Are any further details about the legacy sites available, for example, open pit mine or underground mines, water volumes and flux, etc?

We do not have full details on all of the legacy sites available to share at this initial stage, but if you use the four site examples given in the appendix, this gives a good idea of the types of challenges we are facing. For example, flow rates vary considerably, from 50 m³/day up to 2500m³ per hour. We are interested in solutions over all these flow rates. We can go into further detail about specific sites during Stage 2.

19. Could you give more clarification on the challenges that need to be addressed in the very near future?

The examples in the appendix provide a good overview of both current challenges we are dealing with and future challenges we expect to face. The goals for both the current and future challenges are the same, therefore by addressing the points in this project, your proposal will be just as applicable for current and future closure site challenges.

20. Can we submit a technology that covers two examples given in the case study, or do we need to cover all four target use cases?

The examples in the appendix are simply for guidance and an attempt to summarise the range of water treatment challenges we are facing. Therefore, it is not necessary to address all of them with your technology – we are aware that many good technologies are more applicable for certain conditions than others.

21. Regarding the four target use cases in the Appendix (on the Pioneer Portal), are the average flow rates (m³/h) in the chart the expected performance for our technology?

No, the case studies listed in the appendix are an example, and a good reference point for your submissions to address. However, your technology doesn't have to be able to treat these flow rates, or all the listed constituents.

22. Is the mine water volume finite, or does it have continuous inflow?

The flows do fluctuate, but water flows are mostly continuous.

23. Using phage display technology, we may identify specific peptide scavengers targeting specific contaminants and would be able to do this R&D as a proof-of-concept. Would you consider this relevant, and if so, would there be a single (or few) specific contaminant(s) of highest priority?

This is difficult to define since the highest priority can include the highest value contaminants, but also the most highly regulated contaminants, as well as constituents that have been traditionally the most difficult to treat. For example, for arsenic and some other heavy metals, extremely low concentrations are allowed in the effluent. Copper is also a focus. The order of priority for treatment depends on the site, and the water to be treated. In the case you mention, demonstrating a level of flexibility to adapt your technology to the changing requirements at sites would strengthen your submission.

24. Can you provide any context on the composition of waters that need remediation?

The examples in the appendix provide a good general example of some of the challenges we're looking at solving. The case studies show two acidic sites, an alkaline leachate and neutral wastewater. You'll see some of the challenges include arsenic and boron as an example.

25. Could we data on the typical composition of the mine drainage water, including concentrations?

Other than the examples given in the appendix, we are not able to do this at this stage.

26. Do you have existing analytical data to show rare earth concentrations in your mine wastewater?

Other than the examples given in the appendix, we are not able to do this at this stage.

27. Is vanadium present in any of these waters, and is it of interest? If so, are you able to give information on the concentration?

Yes, there is vanadium present, and it is of interest, however, we are unable to provide specific concentrations at this stage.

28. Do the wastewater streams include any PGM (Platinum Group Metals) material that wasn't listed in the charts?

Yes, the appendix is given as an example. We have done our best to put in what we can, but acid drainage, leachates etc from sites are very complex so not all the information is in there. The appendix gives an idea of what we are dealing with on various sites. Regarding PGMs specifically, yes, they are found in some wastewater streams.

29. You have set a quite difficult target for reducing sulfate concentrations. There is little or no value in the product in this case, so it is not going to be cost effective, although it is achievable. Do you have any comments on this?

Recovering sulfate for value is generally not worthwhile but may be worthwhile to enhance the selective recovery or treatment steps further down the line, improving the effectiveness and efficiency of subsequent treatment steps, so there is benefit in that. This should be addressed if you are looking at sulphate removal/recovery.

30. Is the treatment of brine of interest and is it currently stored in evaporation ponds?

Brine treatment is of interest as many of our sites currently produce brine as a by-product. If you are able to present a technology that can selectively recover or treat contaminants in brine, we would be interested in seeing your submission.

31. If our solution is shortlisted through to Stage 2, will the other contaminants or compounds be disclosed prior to trials?

Yes, as far as we can. It is difficult to do this, since we have so many sites and so many challenges, but we will be working through a series of examples and case studies. But we will certainly work with you to get the information that is most relevant to you to support your submission in Stage 2.

32. Will it be possible to get sample, and how quickly can this be done? Could we sample large volumes?

We will be able to do sampling for those shortlisted to go to Stage 2. We're supportive of doing this, but the timeframes for this stage do not allow for it to be done now. We can provide samples at varying volumes depending on the requirements and ability to transport.

33. Are you trying to achieve Zero Liquid Discharge (ZLD), or will there be a point in a 'treatment train' where you will just want to recover water and not be concerned with selective recovery?

ZLD is certainly interesting at some sites, but not at many. There is a stronger argument for producing fit-for-purpose water that can have a beneficial reuse value for local communities and industries. So, we are certainly interested in technologies that can assist in delivering water recovery.

34. What is the importance of water and water recovery in a proposal, next to metals recovery?

The aim of this challenge is selective recovery of contaminants of value from the MIW. Therefore, we will prioritise metals recovery, but of course if you can demonstrate that metals recovery will enhance the ability or efficiency to recover water, this would be valuable to communicate in your submission.

35. Is sustainable water management and optimization of treatment part of the challenge?

It certainly could be. We have many water treatment processes in place at sites around the globe. If you have technology that can address the selective challenge while optimising a currently applied water treatment process (e.g., high density sludge (HDS), RO), we would be interested in hearing about it.

Previous & Current Solutions**36. Is information available for the current technologies that Rio Tinto is using (or technologies trialed in the past), to compare the benefits of our solution to actual existing processes?**

Different technologies are used at different sites, which is all based around the type of water being treated and the regulatory structure. Some are simply collection and disposal, some are passive wetlands, some active physiochemical processes, membranes etc – we are not currently using any unusual treatment processes. Once we are through this first phase, we can have more discussion in Stage 2 around the base cases.

37. Do you have a publicly available document of methods that you already reviewed and that you could share with the interested community?

We have reviewed this space in the past; however, documents are not publicly available.

38. Have you worked with/ partnered with universities in the past?

We work very closely with several universities across the globe on R&D projects, and therefore are experienced in forming partnerships with universities and other research institutions.

39. There is already a lot of published information in the scientific literature that addresses the issues and targets you have highlighted. Is Rio Tinto aware of these and are you looking for new potential solutions?

We are aware of a lot of the work that has been done in this space in the past, however, we have not yet found a satisfactory solution to the challenges we face. We are looking for new or improved solutions that fill some of these gaps we have identified.

40. What is the reason that you are not directly contacting the R&D groups you identified through your technology reviews but have called for this challenge?

We feel that since we need to put several projects and partners in place at much the same time, this would be a more efficient way to go about the process. So far, this is proving to be a successful way of connecting with new groups and finding out about new technologies that we were not aware of in the past.

Mineral Rights and Intellectual Property (IP)

41. Does Rio Tinto retain the mineral rights to all the sites? Will there be profit sharing for recovered value minerals from the waste, i.e., will the technology providers participate in revenue sharing of the minerals?

This is a good question. This would have to be worked out on a case-by-case basis, and we would need to discuss this later down the line.

42. How would the Intellectual Property (IP) be managed?

The objective of this challenge is for Rio Tinto to support the development of novel technologies to meet the MIW remediation challenges we are facing. We recognise the rights our partners have to IP they are bringing to the projects and what is developed during the projects, and we seek to have access to such IP at terms that are commensurate to the funding we provide in each project. We aim to negotiate terms, including IP, directly with each successful submission, and this process is expected to begin during Stage 2 of the project assessment process

43. Will the partners be allowed to publish the results of their projects they are submitting in the challenge?

As for question around IP, there is no one single approach that would fit all scenarios, and we would look at this on a case-by-case basis in collaboration with each project partner.

Submission Format

44. Is there a template available for the solution submission, or a required format? We have an internal document ready, but it may need some formatting.

Submissions need to be made using the Pioneer Portal, which dictates the format. You can prepare your answers in a separate document and copy and paste your answers into the Portal form. You can upload an appendix to your submission if you would like to, and you can even upload a pitch video if you feel this would help you explain your technology.

45. Should we be submitting a project budget within this submission or identify a project scope or idea? What format should we follow for the budget?

Yes, we would like to see a project budget. This does not need to be very detailed, but an idea of budget would be helpful. It would also be helpful to break the budget up into different milestones to get an idea of how you'd like to be spending the money. For example, submitting a 3-year project proposal with a lump sum figure at the end is not as useful as breaking this project up into stages with an estimated budget for each stage. Please submit the budget in US\$ if possible.

46. In the information document on the Pioneer Portal, there are several metrics which the submission should consider, such as energy performance, solution performance, EGS, etc. However, these were not part of the questions asked on the submission form. Do we need to address these question in the initial submission?

These do not need to be defined in detail in your submission, but your submission should recognise that these are important and that they will be addressed as part of your project plan.

47. I forgot to include some information on my submission. Can I recall my submission, or should I simply make a new submission and include the information?

Unfortunately, your submission cannot be recalled. The best way to ensure that we receive your updated submission correctly is to make another submission with your changes. Please contact us through the Pioneer Portal to inform us of this, and we will ensure that your second submission is the one considered for the challenge.

Consortiums / Project Partners / Funding

48. Can we submit a proposal as a consortium and is this encouraged?

Yes – consortiums are encouraged where they add value to your proposal by bringing in resources and know-how that will help support the development and implementation of your technology. These consortiums can be open to universities, industries, or SMEs. Any co-funding that is accessible through these consortiums would be important to mention in the submission.

49. Should we include our international partners in our submission and is it possible to fund projects outside of Australia?

We're looking for the best partners and technologies from around the world, and our sites are located across the world, so please don't feel restricted by geography

50. Do you encourage submission from individuals or companies?

We're happy to accept submissions from either individuals or companies. However, individuals would need to show they have the capacity to drive development or have considered these needs in your budget as Rio Tinto does not have a laboratory that you could use during your research.

51. Could you clarify the collaboration you support, will Rio Tinto mediate and introduce collaboration, or what does Rio Tinto provide for collaborations, such as consultancy forms, hydrogeology details etc?

If we see synergies between technologies in meeting the challenges of these complex MIW streams, we'd be happy to make the connection. We would do this on a case-by-case basis and of course the decision to pursue any collaboration would be up to each of the parties involved.

52. I have funding on a valorisation of mine waste project through Danida, I would like to apply for co-funding from this grant to get additional resources and staff allocated to the project. Is this a possibility? Or does it have to be a brand-new project?

The project does not need to be “new” - we are happy to support existing projects if we can add value to the development of the technology.

53. If matched funding is not available, would you fund a project alone?

Yes – this is a possibility if no co-funding or other sources of funding are available.

Timelines

54. What is the timeline for possible invited full proposals?

We’re aiming to contact shortlisted applicants towards the end of May. We will then work with those short-listed applicants in order to set a realistic target for submitting Full Proposals during Stage 2. Since the Stage 2 full proposal would be a more detailed document than this Stage 1 submission, it is expected that there would be a longer timeframe for putting together the submission.

55. When do you expect the funded projects to kick off?

This is not defined at this stage, but we’re aiming for the end of the 3rd quarter of this year (end of September).

56. What is the anticipated project duration? 2-3 years?

This will depend on the project goals, complexity and TRL the technology is currently at. But certainly, a project that is aiming to advance two stages in development will likely be looking at 2-3 years, while pilot trials may be only for 6 months.

57. Can we have clarification on the closure date for submission?

Submissions close at 5pm Australian Eastern Standard Time (AEST) on 28th April. Please make sure you check what time this is in your relevant time zone to make sure you don’t miss the submission deadline.

58. Can we have access to the recorded webinars?

The recorded webinars are not available for download, but this Q&A document captures all the questions asked across all three webinar sessions and the team is happy to answer any other questions you may have.