

Från: Tim Hicks <twh@galson-sciences.co.uk>
Skickat: den 17 mars 2021 20:17
Till: Strömberg, Bo
Kopia: Tamara Baldwin
Ämne: RE: LOT S2 and A3 QA Review Report
Bifogade filer: LOT S2 and A3 QA Review Abstract.docx

Hi Bo,

Is this OK? It's a shade over half a page.

Tim

From: Strömberg, Bo <Bo.Stromberg@ssm.se>
Sent: 17 March 2021 13:17
To: Tim Hicks <twh@galson-sciences.co.uk>
Cc: Tamara Baldwin <tdb@galson-sciences.co.uk>
Subject: SV: LOT S2 and A3 QA Review Report

Hi Tim

Did you do the short summery? I did not see it. On half a page.

/Bo

Från: Tim Hicks <twh@galson-sciences.co.uk>
Skickat: den 16 mars 2021 21:37
Till: Strömberg, Bo <Bo.Stromberg@ssm.se>
Kopia: Tamara Baldwin <tdb@galson-sciences.co.uk>; Scully, John R (jrs8d) <jrs8d@virginia.edu>
Ämne: LOT S2 and A3 QA Review Report

Dear Bo,

Please find attached the final version of our LOT S2 and A3 QA Review, which addresses SSM comments on the draft report.

Best regards,

Tim

Dr Tim Hicks
Principal Consultant
Galson Sciences Ltd

www.galson-sciences.co.uk

Summary by the author

This report presents a quality assurance (QA) review of the work done by SKB to retrieve the S2 and A3 parcels from the Long term test of buffer material (the LOT experiment) at the Åspö Hard Rock Laboratory. Each LOT parcel comprises a heated copper tube surrounded by bentonite, with a number of copper coupons and various other test and monitoring instruments included in the bentonite. The S2 and A3 test parcels were recovered in 2019, after 20 years of LOT operation and SKB has analysed corrosion of the copper coupons and tubes from the parcels. The QA review has focused on SKB's copper corrosion analysis.

SKB's management of the LOT S2 and A3 project and the reports on dismantling the test parcels (TR-20-11) and analysing the corrosion of the copper coupons and copper tubes (TR-20-14) were reviewed. This provided an understanding of the reliability of the results from a QA perspective. The review found that SKB's management and QA arrangements were appropriate, meeting modern standards. SKB engaged a number of contractors to work on the project, who all have extensive experience and appropriate management systems for such work. The corrosion experts from the contractor teams worked collaboratively with SKB and co-authored the corrosion report TR-20-14.

It was found that some aspects of the way the LOT project was set up in the 1990s mean that there are limitations in terms of what can be learnt about copper corrosion. For example, the copper coupons, copper tubes and copper reference materials were not pre-characterised. This means that it is difficult to distinguish between defects associated with material preparation and machining and the effects of corrosion under LOT conditions. Also, redox conditions were not monitored so the time of transition from aerobic to anaerobic is uncertain, and there were no measurements of microbial populations in groundwater, so that no clear conclusions can be drawn on the relative effects of microbes and copper corrosion on oxygen consumption.

SKB argues that O₂ was the main oxidant causing copper corrosion before the O₂ was consumed, followed by a period in which aqueous Cu²⁺ may have prevailed as an intermediate oxidant. A long period of minor anaerobic corrosion may have occurred as a result of diffusion of low concentrations of sulphide from groundwater to the copper surfaces. However, uncertainty in the saturation time of the parcels and the effects of different oxygen consumption processes mean that alternative interpretations of system evolution and oxygen availability for corrosion could be made. For example, if full saturation coupled with rapid microbial consumption of oxygen had occurred before the tubes could be exposed to a significant period of increased temperature, then a temperature-dependent anaerobic process would have been responsible for corrosion before any arrival of sulphide. However, any copper corrosion by sulphide attack would far exceed the corrosion depths of penetration that have been estimated could occur by anoxic corrosion in pure water in saturated bentonite. Thus, corrosion by sulphide attack is of greater concern in safety assessments than any postulated corrosion in oxygen-free water. Also, alternative arguments do not support the observation from analysis of different LOT parcel tests conducted over different lengths of time that most corrosion appears to have occurred in the early stages of the tests when conditions are likely to have been aerobic. Thus, although it is not possible to conclude with absolute certainty that corrosion of the copper tubes and coupons occurred predominantly under aerobic conditions in the early stages of LOT, there is no evidence available from these results to suggest that SKB's interpretation of copper corrosion behaviour during LOT exposures is incorrect.

Från: Lotta Rubio Lind <Lotta.Rubio.Lind@skb.se>
Skickat: den 18 mars 2021 11:39
Till: Strömberg, Bo
Kopia: Gerhardsson, Ansi; Egan, Michael
Ämne: SV: Tjänsteantackning möte 8/3-2021

Hej Bo,

Här kommer lite kommentarer och förslag på text för tjänsteanteckningarna. För punkt 2 så har vi missförstått varandra, se ny formulering nedan.

Punkt 1: ”Detta görs normalt **sätt** inte för SSM:s egeninitierade granskningar...” (ändra sätt till sett)

Punkt 2: Nytt textförslag. ”SKB har tidigare meddelat SSM om en avvikelse i förhållande till SKB:s interna ledningssystem, som behövde förtydligas. SKB förklarade att tidsbrist uppstått i projektet och att data från RISE/Swerim använts i skrivandet av rapporten TR-20-14 utan att data först lagts i SKB:s databas SICADA för godkännande. Data hade då genomgått kvalitetssäkring av leverantören enligt leverantörens ledningssystem, men inte kvalitetssäkrats i enlighet med SKB:s ledningssystem. Enligt SKB:s instruktion ska data lagras i databasen SICADA och godkännas innan data används vidare, så som vid skrivande av rapporter i SKB:s rapportserier. Vid tidpunkten då SSM:s konsulter Hicks och Baldwin efterfrågat datarapporteringar från LOT-projektet (dvs. viktminskningsmätningar i samband med betning av korrosionskuponger) så noterade SKB att data använts innan ett godkännande gjorts i databasen SICADA och SKB rapporterade en avvikelse. Data som levererades till SSM och vidare till konsulterna Hicks och Baldwin var godkända data från SICADA.”

Återkom gärna om något är oklart.

Hälsar Lotta

Från: Strömberg, Bo <Bo.Stromberg@ssm.se>
Skickat: den 17 mars 2021 17:22
Till: Lotta Rubio Lind <Lotta.Rubio.Lind@skb.se>
Kopia: Gerhardsson, Ansi <Ansi.Gerhardsson@ssm.se>; Egan, Michael <Michael.Egan@ssm.se>
Ämne: Tjänsteantackning möte 8/3-2021

Hej Lotta

Jag skickar över en preliminär version av tjänsteanteckningen från Skype mötet förra måndagen. Ni får gärna kommentera eller förtydliga någon av punkterna.

Bästa hälsn Bo



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Så här behandlar myndigheten dina personuppgifter:

[Behandling av personuppgifter](#)