

Client: AngloGold Ashanti Australia Limited

**Document Peer Review - Consolidated Report of Findings from
Peer Review Panel**

**Re-calibration of Sunrise Dam Gold Mine central discharge
thickened tailing system cyanide and salinity operating
parameters**

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Executive Summary

A panel of mining and environmental industry consultants has conducted a peer review of the following document:

Donato, D.B. (2010). *Re-calibration of Sunrise Dam Gold Mine central discharge thickened cyanide and salinity operating parameters: re-certification with the International Cyanide Management Code*. Donato Environmental Services, Darwin.

The Peer Review Panel (PRP) is comprised of

- Mr Tom Gibbons (Veritas Metallica Pty Ltd);
- Dr Owen Nichols (Environmental Management and Research Consultants);
- Dr Stuart Halse (Bennelongia Environmental Consultants); and
- Mr Jamie Coad (Jamie Coad and Co).

This peer review is essentially considering the recalibration of operating parameters recommended within the Causational Report. It is noted that the Causational Report, peer reviewed as part of SDGM's initial Code compliance process, refers to management recommendations within the context of an adaptive management process, which should be continually reviewed with new information and on-site data collection. The PRP conclude that the current recalibration of SDGM's operating parameters is consistent with this intent.

The PRP has considered and commented upon each of ten recommendations within the review document. Similarly, the PRP has considered and commented upon each of twenty recommendations within the Causational Report. The PRP find that recommendations within the review document are appropriate, notwithstanding comments and qualifications within this report.

Based upon review of existing data, information, and operating parameters, it is reasonable to conclude that the protective mechanisms as described in the initial certification reports are still effective, and that the WAD CN target values can be recalibrated to reflect the 80th percentile value of 100mg/l, and the 95th percentile value of 125mg/l.

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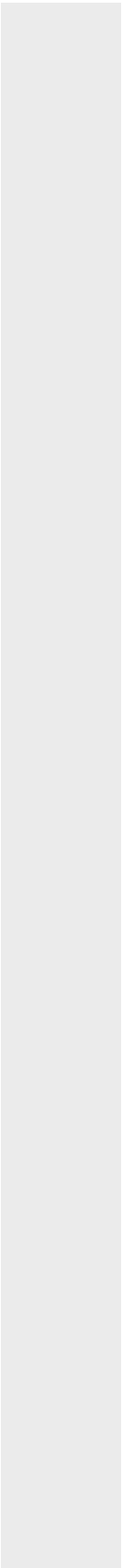
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1 INTRODUCTION

AngloGold Ashanti Australia Limited (AGAA) requires a peer review of a technical report concerning the recalibration of operating parameters at the Sunrise Dam Gold Mine (SDGM). Following a written request by Mr Mike LeRoy of AGAA, four qualified industry consultants accepted the task and were appointed by AGAA. The makeup of the Peer Review Panel (PRP) is as follows:

- Mr Tom Gibbons (Veritas Metallica Pty Ltd);
- Dr Owen Nichols (Environmental Management and Research Consultants);
- Dr Stuart Halse (Bennelongia Environmental Consultants); and
- Mr Jamie Coad (Jamie Coad and Co).

Mr Gibbons was nominated by AGAA as Lead Reviewer, and required to coordinate the Peer Review.

The SDGM hypersaline central-thickened discharge (CTD) tailing system was the first to be peer reviewed and certified under the International Cyanide Management Code (Code) as a system that discharges WAD cyanide above the specified guideline of 50 mg/l. SDGM received full certification in March 2007.

SDGM's re-certification audit for the Code occurred during February 2010. As part of this re-certification process, SDGM management engaged Donato Environmental Services (DES) to reassess the SDGM CTD tailing system operating parameters and make recommendations in the context of the Code, given the continuing lack of wildlife mortalities clearly attributable to cyanosis. It is this reassessment that requires peer review.

This report records the consolidated and agreed findings and comments of the PRP.

2 SCOPE OF WORK

The defined scope of work is as follows:

1. Each Reviewer to provide a statement of credentials;
2. Each Reviewer to provide a statement of independence and no conflict of interest;
3. Each reviewer to provide a written peer review report on the following document:

Donato, D.B. (2010). *Re-calibration of Sunrise Dam Gold Mine central discharge thickened cyanide and salinity operating parameters: re-certification with the International Cyanide Management Code*. Donato Environmental Services, Darwin.

(the "Recalibration Report").

Several additional documents were provided by AGAA for completeness and the benefit of the peer reviewers. It is understood that whilst a formal review of these documents is not required, they will need to be read and referenced if applicable as part of the overall peer review process. The provided documents are:

- (a) Donato, D.B., 2010, Synopsis: Management and monitoring of the Sunrise Dam Gold Mine tailings system in the context of the International Code Management Code, Donato Environmental Services, Darwin.
- (b) Donato, D. B., Gillespie, C. G. and Griffiths, S.R. 2006. ACMER Research Project: 58. A risk assessment of the effects of goldmining cyanide-bearing tailings solutions on wildlife. Sponsor's Report Case Study C, National Research Centre for Environmental Toxicology and ACMER, Brisbane [3], referred to as the Causational Report;
- (c) Donato, D.B. and Smith, G.B. (2007). Summary of Findings: ACMER Project 58, Sunrise Dam Gold Mine Sponsor's Report, AngloGold Ashanti Australia, Donato Environmental Services [5].

- (d) Donato, D.B. (2008). Sunrise Dam Gold Mine Tailings Facility: Compliance Review. Donato Environmental Services, Darwin.
 - (e) Donato, D.B. (2009). Sunrise Dam Gold Mine Tailings Facility: Compliance Review, September 2009. Donato Environmental Services, Darwin.
 - (f) Donato, D.B. (2009). Recalibration of Sunrise Dam Gold Mine central discharge thickened cyanide and salinity operating parameters: re certification with the International Cyanide Management Code. Donato Environmental Services, Darwin.
 - (g) Donato, D.B. (2010). Review of Bat Activity at the Sunrise Dam Gold Mine Tailings System. Donato Environmental Services, Darwin;
4. Hold a peer review teleconference to allow Peer Reviewers to discuss findings; and
 5. Provide a written consolidated Peer Review report.

3 PEER REVIEW PANEL FINDINGS

3.1 Basis and Context

The Recalibration Report describes suggested changes to some of the parameters and recommendations listed in the following two reports:

- The Causational Report; and
- The Summary of Findings Report.

These two reports outline the findings and recommendations on which initial certification of SDGM was granted under the Code. Since the issuing of the Causational Report, essentially three years of data, observation and operating experience has been collected. In addition, DES has carried out annual reviews in September 2008 and August 2009. This ongoing review has resulted in SDGM engaging DES to reassess the operating parameters and make recommendations in the context of the Code, given the continuing lack of wildlife mortalities clearly attributable to cyanosis. The task of the PRP is to review suggested changes to operating parameters and recommendations designed to retain the protective mechanisms and provide the basis for the required monitoring and reporting.

It is noted that the Causational Report, peer reviewed as part of SDGM's initial Code compliance process, refers to management recommendations within the context of an adaptive management process, which should be continually reviewed with new information and on-site data collection.

The PRP conclude that the current recalibration of SDGM's operating parameters is consistent with this intent.

3.2 Discussion

Monitoring since the two reports were produced has continued to show no wildlife mortalities clearly attributable to cyanosis, so it is reasonable to continue to

conclude that the current operating systems and parameters only pose, at most, a very small risk to wildlife. However, the question needs to be considered – has the risk to wildlife increased due to changes to any of the identified protective mechanisms?

The previous reports required that the following parameters be met at CTD spigot discharge:

- <70mg/l WAD CN for 75th percentile;
- WAD CN not to exceed 90mg/l; and
- TDS >90,000mg/l

This WAD CN value is higher than the Code's limit of 50mg/l but this has been deemed acceptable at several Code-certified mines in the region (SDGM, St. Ives and Kanowna Belle) due to the presence of protective mechanisms.

The report provides comparisons with the St Ives hypersaline system (and by inference the Kanowna Belle system). Given the geographical distance between the operations, the question arises of how comparable are the habitats and relative risk?

The PRP note that ecologically, the three operations are in the same geographic division and bioregion, and the at-risk wildlife species are essentially the same throughout the Eastern Goldfields, thus validating this comparison. However, it is recognised that site-specific risks and protective mechanisms must be considered, which is the case for the SDGM system.

At SDGM, the protective mechanisms are:

- There are minimal habitat provisions containing bioavailable cyanide (supernatant and wet tailing) for at-risk species;
- Management procedures are maintained to minimise and reduce structural habitat diversity in the CTD tailing system;

- The minimal food provisions in cyanide-bearing substrates reduces the inadvertent ingestion associated with feeding in solutions and wet tailing; and
- Hypersalinity eliminates the drinking of solutions.

The fourth protective mechanism asserts that hypersalinity “eliminates” the drinking of solutions. This raises the question of whether this should be “minimises” or “reduces to an insignificant quantity”?

However, the PRP note that this terminology has been ratified by the peer review of the MERIWA M398 study. The PRP further note that this report concludes that wildlife do interact (feeding on terrestrial bugs entrained in the tailing) but do not drink. It is thus reasonable to maintain this terminology.

With respect to wet tailing and supernatant solution, the protective mechanisms at SDGM appear to be hypersalinity and the toxicity of the supernatant to invertebrate life, which greatly reduces the chances that the tailing system might be used by wildlife as a feeding area. The hypersalinity of the tailing system will not, in itself, prevent the occurrence of invertebrates (see Pinder et al. 2005 *Hydrobiologia* 543, 1-24).

Causal relationships were demonstrated for the four stated protective mechanisms in the initial, peer reviewed study. By inference, increased risk to wildlife could result if any of these protective mechanisms cease or reduce in effectiveness.

The Recalibration Report states that monitoring since initial certification has revealed that the following parameters, monitored at spigot discharge, have been outside of the operating parameters at some stage:

- Salinity (four cases where values were <90,000mg/l);
- WAD CN

The PRP note that the recalibration report only considers the protective mechanism when salinity is above 90,000 mg/l, and strictly speaking, this is the

boundary of the peer review. However, the occasions when salinity has been outside of the operating parameters, although very few, will likely require some clarification for Code auditors. What were the circumstances? Is there any pattern to this that might increase risk – i.e. links to particular weather events that may concurrently change wildlife presence or utilisation patterns?

From a technical perspective, the relationship between discharge salinity and supernatant salinity should also be investigated. Rainfall would reduce salinity in supernatant water and it is not known exactly at what salinities the water would become 'drinkable' by local species (although it is likely that after high rainfall events, the WAD cyanide concentration in supernatant water would be significantly diluted, and abundant water supplies would exist elsewhere). The links and associated potential risk during periods of reduced salinity are not yet well understood at this site, and as such continued monitoring during these events has merit, as discussed later in this report.

For example, if the volumes of water released are greater when cyanide is least concentrated, it is possible that over the past three years ducks and some other wildlife have used the tailing system only when cyanide concentrations have been 60 mg/L or less. If this (perhaps unlikely) scenario is correct, then the field susceptibility of ducks using the SDGM tailing system to concentrations of 100 and 125.5 mg/L cyanide is unknown.

By contrast to salinity, the WAD CN values do represent an increase and, as noted above, an evaluation is required on the potential increased risk to wildlife. This is consistent with the Code requirement that "any assertion that the 50 mg/l limit is unnecessary must be supported with comprehensive, daily inspection records demonstrating that there are no mortalities". If there is no increase in mortalities and no identified increase in risk, then the operating parameters can be recalibrated as described in the Recalibration Report.

The recorded operating WAD CN discharge values are above the Code recommended figure of 50mg/l, and data from the Causational Report indicate that supernatant values above 50mg/l are therefore likely at times. However, data provided show that the two highest SDGM discharge values of 170mg/l and

240mg/l were recorded more than three years ago. Only two other values (140 mg/l and 150mg/l) are outside the 95th percentile of 132mg/l for St Ives, where WAD CN values are generally higher and the TDS limit of 50,000mg/l is lower. However, as previously noted, care should be taken when comparing across sites as different wildlife utilisation (or potential utilisation) and risk factors may operate.

A key question at SDGM is whether the increase in WAD CN discharge concentrations has resulted in any measurable increase in risk to wildlife? The most reliable indicator of this is recorded mortalities and live visitations. Over the whole time period since initial Code certification, there have been 1,354 wildlife observations recorded but no mortalities clearly attributable to cyanosis (one Red-capped Plover was scavenged by a cat; its initial cause of death was not clear). The PRP also investigated the issue of the single Pelican mortality further with DES, and are satisfied that this is not clearly attributable to cyanosis, as noted in section 3.5 below. Thus, by this measure, there is no clear increase in risk.

Is the monitoring accurate? As part of an adaptive management approach, balloons were used to test the effectiveness of monitoring by mill technicians and environmental staff. This approach has been used elsewhere and is an acceptable method for assessing the efficiency of personnel in detecting whether significant mortalities are occurring (allowing for some bursting).

This methodology is not perfect, and whilst recognizing that SDGM monitoring has probably under-estimated mortality by at least 15% (as this percentage of days were without records), and potentially substantially more (e.g. balloon detection rates were only 84%), the PRP conclude from the existing monitoring system and data that, if significant numbers of mortalities were occurring, or if mortalities were ongoing at low frequency, they would be recorded.

In terms of the wildlife potentially at risk, David Donato provided data on the wildlife occurrence showing 18% of use was by ducks and 43% by small waders, with a further 5% by waders that may be typical inland salt-lake species such as Banded Stilt. No bats were recorded in the monitoring although other studies have shown they are present and they may be as much at risk as birds. Fifteen Eurasian Coots were observed over 4 occasions, which is surprising unless the

tailing system has experienced periods of lower salinity concentrations than suggested in Table 1 of the report.

The training program appears to be taking place and providing observers with sufficient skills to conduct monitoring. However, the PRP bring to the attention of SDGM some occasional systemic omissions. The 2009 compliance report identified some small gaps in implementing the training; these should be addressed, e.g. as per corrective actions noted in Recommendation 19 of the appendix.

So if there are no observed mortalities and the monitoring and training are being carried out as required, do the changes in WAD CN or salinity levels change any of the protective mechanisms and the associated risk to wildlife? Any changes to the four protective mechanisms are considered below:

- Habitat provisions containing bioavailable CN: The report noted that spigot derived ponding has decreased, although at times it is still evident. An open drainage system around the periphery of the CTD tailing system removes excess groundwater and contains WAD CN <1ppm. The decant water is usually <20ppm. Maintenance of high salinity values throughout the system should ensure that risk remains low, even if a small increase in WAD CN levels were to occur. It is noted that the nature of the tailing storage facility, being central-thickened discharge, results typically in a supernatant pond much smaller than seen in a typical paddock-style tailing facilities, and therefore a significantly reduced potential habitat.
- Minimise structural habitat diversity: This has been done and needs to be continued. It is not directly related to any risk associated with changes to salinity or WAD CN levels, but represents an important ongoing protective mechanism.
- Minimal food provisions due to high WAD CN: Any increases in WAD CN levels would, if anything, further reduce aquatic invertebrate utilisation of tailing solution (if this is possible) and decrease food availability, thereby decreasing attractiveness to wildlife. However, no change in surface insect

availability and potential use by bats would be likely. This is discussed further below.

- Hypersalinity: Apart from the four instances noted earlier, hypersalinity at discharge has remained above the recommended 90,000mg/l TDS, so this protective mechanism should still be effective, despite the recorded changes in WAD CN.

Investigation of the Fimiston tailing system by Donato et al. (2009, *Ecotoxicology and Environmental Safety* 72, 1579-1586) suggested that the primary protective mechanism was cyanide concentrations of < 50 mg/L. Shorebird species such as Red-capped Plovers and Red-necked Stints use hypersaline environments and forage in wet hypersaline areas. A secondary protective mechanism was that waterbirds do not drink saline water (Donato et al. suggested a threshold of 59,000 mg/L above which birds would not ingest water, based on studies at one lake). Several species, including Banded Stilt and Red-necked Avocet will feed in water with salinities >100,000 mg/L. It should be recognized that while drinking will not be a significant source of cyanide intake, foraging could potentially be for species such as these if sufficient food was available. Therefore, if the tailing system supported aquatic invertebrates, some mortalities of several bird species would be expected. However, David Donato stated that no invertebrates occur within the SDGM tailing system because the system is toxic to all invertebrate life. All food sources in the area will be blown in by wind.

Overall, apart from the comments below relating to bats, it is reasonable to conclude that the protective mechanisms as described in the initial certification reports are still effective, and the three years monitoring data supports the assertion that frequent deaths of significant numbers of wildlife will not occur at SDGM if the same pattern of cyanide discharge continues to occur (i.e. the scenario on which re-calibration report is based).

The Bat Activity Report describes bat monitoring conducted over 12 months from October 2008 to October 2009. The study concludes that bat activity is much lower over the hypersaline CTD tailing system compared with a control site, as is

the extent of feeding and drinking activity. It is reasonable to conclude that risk to bats from feeding on surface insects and/or drinking, is small. However, the study has a number of limitations, some of which are pointed out. These include:

- Difficulties in identifying some species;
- Extensive variability in bat use patterns exists between nights;
- Little is known about bat CN toxicity thresholds;
- The survey method only enables assessment of relative abundance;
- Variation in seasonal activity was expected but has not yet been observed; and
- A relatively large gap in sampling of 6-7 months occurs between October 2008 and April/May 2009.

Also, it can be seen from Figures 1 and 2 in the Bat Activity Report that the difference between some species on the CTD tailing system and Control sites, for example *Tadarida australis*, is much less than two orders of magnitude, particularly considering the limitations in assessing actual abundance.

The Causational Report notes that, for insectivorous bats, “concentrations above 26ppm WAD CN in ‘fresh’ mine waste solutions are likely to be acutely toxic to this guild”. Thus, all other factors being equal, it is reasonable to take a precautionary principle approach and conclude that risk to bats may be greater than risk to other species for which the WAD CN toxicity threshold is closer to 50mg/l.

The PRP recommend that, in the light of these factors, together with the higher WAD CN levels, seasonal monitoring of bats should continue until patterns of use and associated risks for this group are fully understood.

Overall, it can be concluded from the review of operating parameters that the WAD CN target values can and should be recalibrated to reflect the 80th percentile value of 100mg/l, and the 95th percentile value of 125mg/l. The change from 75th percentile values (within the Causational Report) to 80th and 95th percentile parameters was queried by the PRP. It has been confirmed by DES that the reason for this change is to standardize data with other relevant scientific

studies, thus allowing for cross-comparison and expansion of data sets where appropriate. This approach is reasonable, and does not compromise the validity of conclusions drawn from the Recalibration report.

The recalibration approach, subject to peer review, is consistent with an adaptive management process defined in the Causational Report, and in this instance there is a precedent for the use of 80th and 95th percentile values at both Kanowna Belle and St. Ives.

3.3 Recalibration Report Recommendations

The Recalibration Report describes a revised set of recommendations for maintaining protective mechanisms at the SDGM CTD tailing system, following recalibration as previously described. The following is a list of said recommendations, with commentary from the PRP.

Recommendation 1. The target is to discharge WAD cyanide concentration below 100 mg/L on 80% of operational days, and below 125.5 mg/L on 95% of operational days.

The PRP accept this recommendation, on the understanding that the protective mechanisms described in the initial certification reports are still effective and that cyanide-induced wildlife mortality occurs, at most, only sporadically and in very low numbers. However, it is noted that no upper operating limit exists. There is concern that a circumstance may arise where a number of consecutive days of discharge above 125.5 mg/L WAD cyanide occur. Therefore, the PRP recommend that the recalibration report be revised in consideration of this concern, and that a target upper operating limit be specified.

The PRP note that within the current SDGM Cyanide Management Plan (SD_PR_PD_CM_PRO_017_Cyanide Management Plan Ver 3.0, March 2010), management controls for WAD CN levels are outlined in Section 4.4 (pg 21-28). Therefore, the PRP recommend that whenever a value above 125.5 mg/L is

recorded, SDGM will need to take immediate and appropriate action to ensure that WAD cyanide concentration is less than 125.5 mg/L by the following day.

Recommendation 2. Maintain discharge salinity above TDS of 90 000 mg/L and monitor daily.

The PRP consider this recommendation appropriate. The PRP note that there is merit in continuing to gather data to improve understanding of the relationship between salinity concentration and WAD CN concentration, particularly during non-typical operating conditions.

The PRP further note that SDGM are required to respond accordingly to decreases in tailing salinity caused by significant rainfall events. The PRP understand that this response is documented in SDGM's Cyanide Management Plan.

Recommendation 3. Daily monitor WAD cyanide concentration at discharge to the tailings system.

The PRP consider this recommendation appropriate whilst discharge exceeds 50 mg/l WAD CN.

Recommendation 4. Duplicate tailings samples (WAD cyanide and TDS) to be taken from the spigot discharge point.

The PRP consider this recommendation appropriate.

Recommendation 5. Daily wildlife monitoring by trained staff.

The PRP consider this recommendation appropriate. The PRP note the importance of this recommendation, particularly if WAD CN discharge levels change. Seasonal monitoring of bats should continue until patterns of use and associated risks for this group are fully understood and the likelihood of cyanide-related mortalities is shown to be acceptably low.

Recommendation 6. Incorporate intensive monitoring by external experts in the event of cyanide-related wildlife mortality.

The PRP consider this recommendation appropriate.

Recommendation 7. Wildlife monitoring data management

The PRP consider this recommendation appropriate. The PRP further note that this data is important for Code compliance and to continue to improve understanding of any links between operating parameters and impacts on wildlife.

Recommendation 8. Environmental and technical staff wildlife monitoring training

The PRP consider this recommendation appropriate and suggests that training includes a requirement to identify, to species level, any wildlife considered likely to be at risk. There must be an emphasis on the importance of recording the occurrence of these species daily, together with any mortalities and other routine wildlife monitoring data.

Recommendation 9. Manage supernatant surface area to less than 2 Ha

The PRP consider this recommendation appropriate.

The PRP have reviewed the SDGM log sheet relevant to this management initiative (SD_EN_FOR_013 - ACMER Wildlife Inspection), and recommend that it be enhanced by adding a simple guideline to assist personnel to arrive at a supernatant surface area estimate.

Recommendation 10. Minimise infrastructure in the vicinity of cyanide-bearing habitats

The PRP consider this recommendation appropriate.

3.4 Causational Report – Revision of Recommendations

The Recalibration report discussed the original recommendations contained within the Causational report, with commentary on each, and a recommendation to retain, retain and refine, or remove. This is contained within the appendix of the Recalibration report, entitled 'Appendix: Management recommendations of the Causational Report (ACMER P58 study)'.

The following is a list of said recommendations, with commentary from the PRP.

Recommendation 1: Manage (tailings) spigot discharge salinity similar to that experienced during this project. It was above 139 000 TDS for 75% of sampled days. It is recommended not to discharge tailings below 90 000 ppm total dissolved solids (TDS) if WAD cyanide discharge concentration is to exceed 50 ppm without protective measures.

The Recalibration Report recommends that this be retained as recommendation 2 and re-worded as follows:

Recommendation 2. Maintain discharge salinity above TDS of 90 000 mg/L and monitor daily.

The PRP consider this amendment appropriate, and note that it is consistent with retention as Recommendation 2.

Recommendation 2: Consider strategically managing spigots to stop the formation of spigot-derived ponding on the periphery of the CTD.

The Recalibration Report recommends that this be removed on the basis that hypersaline protective mechanisms were found to be effective on spigot-derived pooling and supernatant, which was conclusively researched and documented as part of the MERIWA M398 project, thus rendering the recommendation superfluous.

The PRP consider this revision appropriate. However, it is noted that this recommendation is good operating practice, and encourages SDGM to continue this practice where practical.

Recommendation 3: Limit WAD cyanide at the discharge spigot at 70 ppm for 75% of the time and do not to exceed 90 ppm.

The Recalibration Report recommends that this be retained with recalibrated discharge parameters, becoming Recommendation 1.

The PRP consider this revision appropriate, and note that it is consistent with retention as Recommendation 1.

Recommendation 4: Daily salinity monitoring in the mill process circuit.

The Recalibration Report recommends that this be removed on the basis that this recommendation is not necessary to either maintain or monitor the protective mechanisms.

The PRP consider this appropriate. The PRP further note that salinity monitoring of the SDGM CTD tailing system remains important.

Recommendation 5: Daily cyanide monitoring at the spigot discharge point.

The Recalibration Report recommends that this be retained, becoming Recommendation 3.

The PRP consider this recommendation appropriate, and note that it is consistent with retention as Recommendation 3. The PRP suggest that SDGM also monitor (at a lesser frequency) WAD CN levels in process water, particularly if process water is used for tailing pipeline flushing.

Recommendation 6: Restrict wildlife access by maintaining fencing of cyanide-bearing water bodies.

The Recalibration Report recommends that this be removed on the basis that this recommendation is not necessary to either maintain or monitor the protective mechanisms.

The PRP do not support this recommendation, as it is considered that the fence is integral to the protective mechanisms of the SDGM CTD tailing system. The PRP consider that the current electrified perimeter fencing around the SDGM CTD tailing system provides an important physical barrier to protect wildlife, and note that this forms part of SDGM's Cyanide Management Plan. The PRP further note that the requirement and appropriateness of a fence is considered within the typical Code audit process.

Recommendation 7: Manage supernatant surface area to less than 2 Ha.

The Recalibration Report recommends that this be removed on the basis that hypersaline protective mechanisms were found to be effective on spigot-derived pooling and supernatant, which was conclusively researched and documented as

part of the MERIWA M398 project, thus rendering the recommendation superfluous.

The PRP find this inconsistent with the stated intent to retain this recommendation earlier in the Recalibration report. The PRP recommend that this practice be retained as Recommendation 9 as originally stated.

Recommendation 8: Minimise infrastructure in the vicinity of cyanide-bearing habitats.

The Recalibration Report recommends that this be removed on the basis that this recommendation is not necessary to either maintain or monitor the protective mechanisms.

The PRP find this inconsistent with the stated intent to retain this recommendation earlier in the Recalibration report. The PRP recommend that this practice be retained as Recommendation 10 as originally stated.

Recommendation 9: Restrict wildlife access by flattening raised earth and dry tailings piles that form islands in the CTD.

The Recalibration Report recommends that this be removed, on the basis that the CTD tailing system within its perimeters is completely covered with tailing. Bare ground creating islands no longer exists, thus rendering this recommendation redundant.

The PRP consider this appropriate.

Recommendation 10: Daily cyanide monitoring of spigot-derived ponding supernatant.

The Recalibration Report recommends that this be removed on the basis that hypersaline protective mechanisms were found to be effective on spigot-derived pooling and supernatant, which was conclusively researched and documented as part of the MERIWA M398 project, thus rendering the recommendation superfluous.

The PRP agree that daily monitoring of the spigot-derived ponding supernatant may not be required, given the above argument. However, the PRP note that occasional excursions in WAD CN concentration have been recorded in supernatant pond samples, although no mortalities were observed in these instances. Thus, the PRP consider ongoing monitoring of supernatant water bodies for both salinity and WAD CN is important to continue to improve the understanding of the relationship between discharge and supernatant concentrations. This monitoring could occur at a frequency deemed appropriate by DES, and the PRP note that such information would be particularly useful during non-typical operating practice.

Recommendation 11: Monitor mill cyanide dosage rates daily.

The Recalibration Report recommends that this be removed on the basis that the critical measure is cyanide concentration at discharge to the CTD tailing system (now recommendation 3), not the mill process circuit. It is asserted that, although good practice, this recommendation is not necessary to either maintain or monitor the protective mechanisms.

The PRP consider this appropriate. However, the PRP note that such practice is an industry standard, and is required for Code compliance within other Code Standards of Practice.

Recommendation 12: Duplicate tailings samples to be taken from the spigot discharge point.

The Recalibration Report recommends that this be retained with amended wording, becoming Recommendation 4.

The PRP consider this revision appropriate, and note that it is consistent with retention as Recommendation 4.

Recommendation 13: Monitor rainfall-induced ponding on inactive tailings areas.

The Recalibration Report recommends that this be removed on the basis that hypersaline protective mechanisms were found to be effective on spigot-derived pooling and supernatant, which was conclusively researched and documented as part of the MERIWA M398 project, thus rendering the recommendation superfluous.

The PRP consider this revision appropriate, but note that opportunistic sampling of such ponding, consistent with comments on Recommendation 10 above, will further improve understanding of the SDGM CTD tailing system.

Recommendation 14: Sample dry tailings.

The Recalibration Report recommends that this be removed on the basis that the defined task has been completed since certification and is no longer necessary.

The PRP consider this appropriate.

Recommendation 15: Daily wildlife monitoring by trained staff.

The Recalibration Report recommends that this be retained, becoming Recommendation 5.

The PRP consider this appropriate, and note that it is consistent with retention as Recommendation 5.

Recommendation 16: Incorporate intensive monitoring by external experts in the event of cyanide-related wildlife mortality.

The Recalibration Report recommends that this be retained, becoming Recommendation 6.

The PRP consider this appropriate, and note that it is consistent with retention as Recommendation 6.

Recommendation 17: Wildlife monitoring data management.

The Recalibration Report recommends that this be retained, becoming Recommendation 7.

The PRP consider this appropriate, and note that it is consistent with retention as Recommendation 7.

Recommendation 18: Preventative wildlife emergency planning.

The Recalibration Report recommends that this be removed on the basis that emergency procedures for maintaining salinity are best developed by SDGM and a prescriptive recommendation is not necessary and may be counterproductive. The salinity threshold necessary is now provided in recommendation 2. It is asserted that the existence and appropriateness of emergency response is best assessed through the (Cyanide Code) auditing process - Standard of Practice 8.

The PRP consider this appropriate. The PRP note that the 2009 Management Review concluded that this requirement is met through the existence of the Cyanide Management Plan, Section 4.4. The PRP note that the existence and

appropriateness of emergency response is assessed within Standard of Practice 8 of the Code.

Recommendation 19: Environment and technical staff wildlife monitoring training.

The Recalibration Report recommends that this be retained, becoming Recommendation 8.

The PRP consider this appropriate, and note that it is consistent with retention as Recommendation 8.

Recommendation 20: Public dissemination.

The Recalibration Report recommends that this be removed on the basis that, although good practice, this recommendation is not necessary to either maintain or monitor the protective mechanisms.

The PRP consider this appropriate. The PRP note that, consistent with comments on Recommendation 18 above, this requirement is assessed within Standard of Practice 9 of the Code.

3.5 General Comments and Corrections

The following is a list of comments and corrections specific to the Recalibration Report. This list is provided to give AGAA suggestions on the report content and format, and to alert SDGM to related findings.

No.	Page	Comment
1.	i	The Report title seems to be missing some terminology – a suggested addition (underlined) is as follows: Re-calibration of Sunrise Dam Gold Mine central-thickened <u>tailing system</u> cyanide and salinity operating parameters: re-certification with the International Cyanide Management Code.
2.	6	There is mention of “fresh peripheral discharge tailings systems” – for avoidance of doubt, it is suggested that this be changed to “fresh water” as applicable.
3.	6	The wildlife cyanosis impact formula references a Human health guideline (ref 14) – this should be checked with DES to check for validity.
4.	6	Equation 2 is a little confusing – it is re-written in what is believed is an equivalent equation below. This has been proposed to and accepted by DES. $\text{Impact}_0 = f \text{Exposure}_{\text{tpd}} \times ([\text{CN WAD}] < 50\text{ppm})$
5.	6	The final sentence is unclear – it is recommended that this be clarified and re-phrased.
6.	9	It is noted that a CTD and Storm Water Pond routine inspection was missed by mill technicians – this is a systemic alert to SDGM operations.
7.	9	The final sentence states that “this coupled with environmental staff observations provides the evidence....” – it is unclear whether this refers to decoy balloon observations, or the lack of observed wildlife deaths.
8.	10	Paragraph 3 – the term “statical” should read “statistical”.
9.	11	The first paragraph refers to 80% and 95% percentiles – this

No.	Page	Comment
		should be changed to 80th and 95th percentiles.
10.	11	The term “formulae” in the second paragraph should be changed to “formula”.
11.	11	The report notes that the SDGM CTD tailing system has no supernatant (water body). This is not strictly correct, and whilst a typical central supernatant pond is not present, the report should reflect the presence of a (significantly smaller and typically peripheral) supernatant pond.
12.	11	The term “attenuated” should read “attenuator”
13.	12	The first sentence “...of a possible 1,187..” It is inferred that a term is missing – likely to be “days” or “occasions”.
14.	12	<p>It is noted that occasional physical entrapment of kangaroos in slurry is documented at many other operations, including non-gold operations that contain no cyanide.</p> <p>The review report references a Pelican death within the SDGM system, but states that it is not attributed to cyanide.</p> <p>Further clarification on this matter was sought from DES. It is subsequently noted that the species is only found in the region after significant rainfall usually associated with cyclones, where it feeds on fish in temporary lakes formed by post-cyclonic rain-bearing depressions. DES conclude that this solitary Pelican, a fish eater, had essentially become lost searching for water bodies containing fish and starved to death. DES conclude that the CTD tailing system is not their habitat, they do not drink (and the solution is well below 10mg/l WAD CN) and don’t feed in tailing (i.e. mud type) habitats.</p>
15.	15	<p>Recommendation 9 – The question arises of the methodology of estimating supernatant surface area, and whether it is sufficiently accurate for the purposes of this recommendation.</p> <p>Further clarification from DES confirms that the estimate is a simple geometric estimate (by eye). It is recommended that SDGM provide a simple guideline to assist personnel to arrive at an estimate.</p>
16.	16	Recommendation 3 – the words ‘and do not to exceed’ do not

No.	Page	Comment
		seem right, although they are the same in all the reviewed reports.

Reviewer Credentials Form

Document Reviewed: Donato, D.B., (2009). Re-calibration of Sunrise Dam Gold Mine central-discharge thickened cyanide and salinity operating parameters: re-certification with the International Cyanide Management Code, Donato Environmental Services, Darwin.

Date: 14 January 2010

Lead Reviewer Credentials

Lead Reviewer: Tom Gibbons
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Experience: peer reviewer

Year	Type of Facility, Type of Review	Country & State/Province
2006-2009	6 CIL Cyanidation Operations; CN Code Gap Analysis and Compliance Project	Australia (WA, NSW, Tas); PNG
2003-2006	2 CIL Cyanidation Operations; CN Code Gap Analysis and Compliance Project	Australia (WA, NT)
2001-2003	4 CIL Cyanidation Operations; CN Code Gap Analysis	Australia (WA, Qld)

Related Experience

Reviewer	Yrs.	Relevant Position Titles	Types of Operations/Reviews
T Gibbons	3	Group Metallurgist	6 CIL Cyanidation Operations/ CN Code Gap Analysis and Compliance Project
T Gibbons	3	Chief Metallurgical Engineer	2 CIL Cyanidation Operations; CN Code Gap Analysis and Compliance Project
T Gibbons	2	Consultant	4 CIL Cyanidation Operations; CN Code Gap Analysis

Statement of No Conflict

I certify that I have not audited any component of this facility for which I was responsible for design or development; nor have I within the past year been an employee of the facility, its parent company, or associated affiliates. Excluding audits, I have not derived more than 30% of my income within the past 5 years from the facility, its parent, or associated affiliates. I have not participated in more than two consecutive Cyanide Code audits of this facility. I have participated in at least 3 health, safety, and/or environmental audits, inspections or reviews in the past 7 years and am familiar with standard audit procedures as well as with the protocols developed by the International Cyanide Management Institute for implementation of the Code.

Signed,
Lead Reviewer*

Name
Tom Gibbons

Signature



Date

12/01/2010

Reviewer 1
Reviewer 2
Reviewer 3
Reviewer 4

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Use additional pages if necessary

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Reviewer Credentials Form

Document Reviewed: Donato, D.B., (2009). Re-calibration of Sunrise Dam Gold Mine central-discharge thickened cyanide and salinity operating parameters: re-certification with the International Cyanide Management Code, Donato Environmental Services, Darwin; and associated documentation.

Date: 19 January 2010

Reviewer Credentials

Reviewer: Dr. Owen Nichols
 Telephone Number: +61 733535224
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Experience: peer reviewer


Year	Type of Facility, Type of Review	Country & State/Province
2008/2009	Newmont Waihi Gold, wildlife risk and ICMC compliance (Lead Peer Reviewer)	New Zealand
2009	Newmont Boddington Gold, wildlife risks and ICMC compliance (Lead Peer Reviewer)	Australia (WA)
2008	Influence of hypersaline tailings on wildlife cyanide toxicosis: St. Ives, Granny Smith and Kanowna Belle mines (MERIWA Project Reviewer)	Australia (WA)
2010	Reviewer of Guidelines for Wetland Establishment in the Oil Sands Industry	Canada (Alberta)

Related Experience

Reviewer	Yrs.	Relevant Position Titles	Types of Operations/Reviews
O. Nichols	19	Principal, Environmental Management and Research Consultants	Numerous projects related to wetland creation, ecology and wildlife utilization, including promotion of wildlife colonization of rehabilitated wetlands and reducing risks of wildlife utilization of caustic residue storage areas (Alcoa, WA)
O. Nichols	“ “	“ “	Extensive experience designing, implementing and reviewing wildlife monitoring programs for numerous mining companies (Alcoa, KPC Indonesia, CRL Qld, others)

Statement of No Conflict

I certify that I have not audited any component of this facility for which I was responsible for design or development; nor have I within the past year been an employee of the facility, its parent company, or associated affiliates. Excluding audits, I have not derived more than 30% of my income within the past 5 years from the facility, its parent, or associated affiliates. I have not participated in more than two consecutive Cyanide Code audits of this facility. I have participated in at least 3 health, safety, and/or environmental audits, inspections or reviews in the past 7 years and am familiar with standard audit procedures as well as with the protocols developed by the International Cyanide Management Institute for implementation of the Code.

Signed,	Name	Signature	Date
Lead Reviewer*	Tom Gibbons		
Reviewer 1	Owen Nichols		19 Jan 2010
Reviewer 2			
Reviewer 3			
Reviewer 4			

Use additional pages if necessary

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Stuart Halse - Curriculum Vitae

Qualifications

B Sc (Hons) 1977 University of Western Australia
Ph D 1983 University of the Witwatersrand, Johannesburg. Thesis title - Feeding, reproduction and body composition of Spur-winged Geese

Nationality

Australian. Born Perth, Western Australia

Employment status

Managing Director, Bennelongia Pty Ltd
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Professional experience

Career summary

1972-1976 Undergraduate Science degree in zoology, University of Western Australia
1977 Research Assistant, Western Australia Museum working on reproduction in bats
1978 Research Assistant, Agriculture Protection Board, Western Australia, working on parrots
1979 Research Officer, Department of Surgery, University of Western Australia working on gall bladder disease
1980-1882 PhD, University of the Witwatersrand studying ecophysiology of Spur-winged Geese
1983 Environmental consultant, Telafer (north of Mosel), Iraq working on solutions to damage to pasture and crops caused by grazing Skylarks and other birds
1984 Tutor, University of Tasmania
1985-2007 Senior Principal Research Scientist, Department of Environment and Conservation, Perth WA, working on wetlands, aquatic animals and subterranean fauna. Main source of advice to WA Government on wetland management and subterranean fauna
2007-present Managing Director, Bennelongia Pty Ltd. Environmental consultants specializing in subterranean fauna and wetland survey

Major research projects/consulting

1988-1989 Aquatic invertebrate conservation values of Leschenault Inlet in relation to the need for mosquito control and physical modification of salt marsh habitat
1988-1992 Waterfowl counts in south-west WA. Organised ground counts by volunteers and undertook aerial counts for twice-yearly estimate of waterfowl populations at 1250 lakes and wetlands, estuaries, river pools, dams to establish waterbird population trends
1989-1992 Waterbird use of wetlands on Swan Coastal Plain. Organised counts by volunteers and undertook habitat measurements at 230 wetlands in the city of Perth and surrounding countryside to study seasonal variation in waterbird numbers and establish how the characteristics of a wetland affect use

1989-2006	Waterbird and aquatic invertebrate surveys of Lake Gregory, Kimberley. Studied long-term trends in waterbird numbers and other biological attributes of the wetland, with involvement of local indigenous community to improve management of the wetland
1994-1997	Southern Carnarvon Basin biological survey. Winter and summer surveys of aquatic invertebrates and aquatic invertebrates at 56 wetlands as part of a larger survey of the biota of the region to provide basis for selecting additional nature reserves
1994-2001	Monitoring River Health Initiative (AusRivAS program). National Australian program based on the English RIVPACS system to assess river condition using macroinvertebrates as an indicator of health. Built models for Western Australia (1994-96) and then assessed condition across WA (1997-99)
1994-2007	Taxonomic studies of ostracods, copepods and other crustaceans
1997-2002	Southern Agricultural Zone biological survey. Spring surveys of aquatic invertebrates and waterbirds of 232 wetlands in the Wheatbelt as part of a larger survey of the biota of the region to provide basis for selecting recovery catchments (areas of high conservation value for wetlands and terrestrial ecosystems that will be managed to reduce the risk of secondary salinisation and consequent damage to the biota)
1997-2007	Wetland monitoring in the Southern Agricultural Zone. Monitoring of aquatic invertebrates, waterbirds, and vegetation condition at 25 Wheatbelt wetlands to examine biological impact of salinisation and success of remediation measures
2002-2007	Pilbara biological survey. Surveyed stygofauna at ca. 500 bores and wells to document distribution of species and factors controlling occurrence
2006-2007	Avon Baseline project. Mapping all wetlands in the Avon catchment of south-west WA, classifying them into wetland types and evaluating biological values. Mapping and assessment done remotely with ground-truthing at selected sites
2007-present	Environmental assessment surveys and advice focusing on subterranean fauna in the Pilbara and Yilgarn of Western Australia. Also providing wetland management advice
2008	National Waterbird Count. Collaboration with University of NSW. First national count of waterbirds by aerial survey of all major wetlands and selected smaller wetlands across Australia. Validation counting to assess efficiency of aerial survey

Selected consultancy projects

1983	Finding solutions to bird damage to pasture and crops in northern Iraq. For Western Australian Overseas Project Authority and Ministry of Agriculture, Iraq
1994-1995	Assessment of waterbird numbers on the middle Fly River Floodplain. For BHP Billiton Ltd
2003	Guidance for the assessment of environmental factors: subterranean fauna. For Environmental Protection Authority
2007	Guidance for the assessment of environmental factors: sampling methods for subterranean fauna. For Environmental Protection Authority Assessment of risk to stygofauna at the Cloud Break Project. For Fortescue Metals Group Ltd Scoping work required to determine Ecological Water Requirements for stygofauna in Exmouth Cape Aquifer. For Department of Water Assessment of conservation status of wetlands in the Trayning area in relation to disposal of saline deep drainage water. For Avon Catchment Council Review of the potential hazard of elevated molybdenum levels in the tailings storage facility of the Spinifex Ridge Project. For Moly Mines Pty Ltd
2008	Literature review and monitoring program for stygofauna in the Gngangara Mound. For Department of Environment and Conservation Protection of troglifauna in staged development of mining at F Deposit, Area C Mine. For BHP Billiton Iron Ore Troglifauna survey of the Orebody 18 Mine Modification. For BHP Billiton Iron Ore Troglifauna survey at Koolyanobbing and Mt Jackson. For Portman Iron Ore Troglifauna survey at in the Cape Preston area. For Mineralogy Pty Ltd Biological Monitoring at Lake Cowan. For Central Norseman Gold Corporation

An assessment of likely impacts on waterbird values of re-alignment of the Preston River - Leschenault Inlet. For Bunbury Port Authority

See Publications page www.bennelongia.com.au for fuller list

Government management and policy experience

- 1995-2007 On-going advice to Government and community groups regarding wetland management
- 1986 Prepared management plan for Herdsman Lake, a Perth wetland created in old land-fill site by dredging and creating waterbird habitat
- 1989 Prepared nominations of first 9 WA wetlands placed on Ramsar list (in 1990)
- 1995-2007 On Technical Advisory Committees for all 5 Recovery Catchment wetlands in WA (providing advice on how to control salinisation and maintain the conservation values of these wetlands through local and catchment-scale management)
- 1996-1997 Member of management planning team for Lake Warden Ramsar site
- 2000-2002 Member of committee preparing guidelines for wetland buffers in association with urban development
- 2000-2007 Provided technical advice to DEC, EPA and Government on subterranean fauna for environmental assessment purposes, including the Orebody 23 review
- 2002-2007 Member of Wetland Classification and Evaluation Committee developing a protocol for wetland mapping, classification and evaluation to be used throughout WA and ratifying groups undertaking this work
- 2003 Wrote EPA Guidance Statement 54 outlining policy on subterranean fauna assessment for EPA
- 2005 Review for the Minister of the Environment of the wetland mapping and evaluation work done by the Department of Water in association with urban development and the designation of public open space around the Campbell Road wetlands
- 2007 Wrote technical guidance on subterranean fauna sampling methods for EPA (Guidance Statement 54A)

Other relevant activities

- Associate Editor for international aquatic science journal *Hydrobiologia*
- Waterbird editor for the Australia ornithological journal *Corella*
- Honorary Research Associate of the Royal Belgian Institute of Natural Resources
- Member of freshwaterBIODIVERSITY (a cross-cutting network of DIVERSITAS – see http://www.diversitas-international.org/cross_freshwater.html)
- Independent scientist on WA Wetlands Coordinating Committee (role is to ensure the activity of Government departments is coordinated and achieves best management of wetlands)

Stuart Halse's Publication List

REFEREED JOURNAL PAPERS AND CONFERENCE PROCEEDINGS

99. **Halse, S.A.**, Scanlon, M.D., Cocking, J.S., Barron H.J. & Eberhard, S.M. Pilbara stygofauna: deep groundwater of an ancient landscape contains globally significant radiation of biodiversity. In preparation.
98. Finston, T., Johnson, M.S., Eberhard, S.M, Cocking, J.S., McRae, J.M., **Halse, S.A** and Knott, B. 2007. New genus and species of groundwater paramelitid amphipods from the Pilbara, Western Australia: a combined molecular and morphological approach. *Invertebrate Systematics* (submitted).
97. Pinder, A.M, **Halse, S.A**, Shiel, R.J. & McRae, J.M. An arid zone awash with diversity: patterns in the distribution of aquatic invertebrates in the Pilbara region of Western Australia. *Records of the Western Australian Museum Supplement* (in press).
96. Adamowicz, S.J., Menu-Marque, S., **Halse, S.A.**, Topan, J., Zemlak, T., deWaard, J. & Hebert, P.D.N. 2010. The evolutionary diversification of the Centropagidae (Calanoida, Copepoda): a history of habitat shifts. *Molecular Phylogenetics and Evolution* doi:10.1016/j.ympev.2009.12.008.
95. Schon, I., Martens, K. & **Halse, S.** 2010. Genetic diversity in Australian ancient asexual *Vestalenula* (Ostracoda, Darwinulidae) – little variability down-under. *Hydrobiologia* DOI 10.1007/s10750-009-0057-6.

94. Eberhard, S.M., **Halse, S.A.** †, Williams, M.R., Scanlon, M.D., Cocking, J.S. and Barron, H.J. 2009. Exploring the relationship between sampling efficiency and short range endemism for stygofauna in the Pilbara region, Western Australia. *Freshwater Biology* **54**, 885-901. †**Corresponding author**
93. Horwitz, P., Rogan, R., Halse, S., Davis, J. & Sommer, B. 2009. Wetland invertebrate richness and endemism on the Swan Coastal Plain, Western Australia. *Marine and Freshwater Research* **60**, 1006–1020.
92. Reeves, J.M., De Deckker, P. and **Halse, S.A.** 2007. Groundwater ostracods from the arid Pilbara region of northwestern Australia: distribution and water chemistry. *Hydrobiologia* **585**, 99-118.
91. Lyons, M.N., **Halse, S.A.** †, Gibson, N., Cale, D.J., Lane, J.A.K., Walker, C.D., Mickle, D.A. and Froend, R.H. 2007. Monitoring wetlands in a salinizing landscape: case studies from the Wheatbelt of Western Australia. *Hydrobiologia* **591**, 147-164. †**Corresponding author**
90. **Halse, S.A.**, Scanlon, M.D., Cocking, J.S., Smith, M.J. and Kay, W.R. 2007. Factors affecting river health and its assessment over broad geographic ranges: the Western Australian experience. *Environmental Monitoring and Assessment* **134**, 161-175.
89. Finston, T.L., Johnston, M.S., Humphreys, W.F., Eberhard, S.M. and **Halse, S.A.** 2007. Cryptic speciation in two widespread subterranean amphipod genera reflects historical drainage patterns in an ancient landscape. *Molecular Ecology* **16**, 355-365.
88. Strehlow, K., Davis, J., Sim, L., Chambers, J., McGuire, M., **Halse, S.**, Hamilton, D., Horwitz, P., McComb, A. and Froend, R. 2005. Temporal variation, alternative states and macroinvertebrate community composition in primary and secondary saline wetlands in southern Western Australia. *Hydrobiologia* **552**, 20-34.
87. Pinder, A.M., **Halse, S.A.**, McRae, J.M. and Shiel, R.J. 2005. Occurrence of aquatic invertebrates of the Wheatbelt region of Western Australia in relation to salinity. *Hydrobiologia* **543**, 1-24.
86. **Halse, S.A.** and Massenbauer, T. 2005. Putting science into wetland management: lessons from recovery catchments in saline landscapes. *Hydrobiologia* **552**, 35-46.
85. **Halse, S.A.**, Pearson, G.B., Hassell, C., Collins, P., Scanlon, M.D. and Minton, C.D.T. 2005. Mandora Marsh, north-western Australia, an arid zone wetland in maintaining continental populations of waterbirds. *Emu* **105**, 115-125.
84. Finston, T., Johnson, M., Humphreys, W., Eberhard, S. and **Halse, S.** 2005. Haplotype diversity in *Pilbarus millsii*, a widespread groundwater species of amphipod from the Pilbara, Western Australia. In *World Subterranean Biodiversity: Proceedings of an International Symposium, 8-10 December 2004, Villeurbanne France* (ed. J. Gibert) pp. 69-71. Equipe Hydrobiologie at Ecologie Souterraines, Université Claude Bernard Lyon, Villeurbanne.
83. Eberhard, S.M., **Halse, S.A.**, Scanlon, M.D., Cocking, J.S. and Barron, H.J. 2005. Assessment and conservation of aquatic life in the subsurface of the Pilbara region, Western Australia. In *World Subterranean Biodiversity: Proceedings of an International Symposium, 8-10 December 2004, Villeurbanne France* (ed. J. Gibert) pp. 61-68. Equipe Hydrobiologie at Ecologie Souterraines, Université Claude Bernard Lyon, Villeurbanne.
82. Eberhard, S.M., **Halse, S.A.** and Humphreys, W.F. 2005. Stygofauna in the Pilbara region, north-west Western Australia: a systematic review. *Journal of the Royal Society of Western Australia* **88**, 167-178.
81. Walshe, T.V., **Halse, S.A.**, McKenzie, N.L. and Gibson, N. 2004. Toward identification of an efficient set of conservation recovery catchments for Western Australian wheatbelt biodiversity. *Records of the Western Australian Museum Supplement* **67**, 65-84.
80. Pinder, A.M., **Halse, S.A.**, McRae, J.M. and Shiel, R.J. 2004. Aquatic invertebrate assemblages of wetlands and rivers in the wheatbelt region of Western Australia. *Records of the Western Australian Museum Supplement* **67**, 7-37.
79. **Halse, S.A.** and McRae, J.M. 2004. New genera and species of giant ostracods (Crustacea: Cyprididae) from Australia. *Hydrobiologia* **524**, 1-52.
78. **Halse, S.A.**, Lyons, M.N., Pinder, A.M. and Shiel, R.J. 2004. Biodiversity patterns and their conservation in wetlands of the Western Australian wheatbelt. *Records of the Western Australian Museum Supplement* **67**, 337-364.
77. **Halse, S.A.** 2004. Biological impacts of drainage disposal in wetlands of the Western Australian wheatbelt. In *Proceedings of the 1st National Salinity Engineering Conference* (eds S Dogramaci and A. Waterhouse) pp. 373-378. Institution of Engineers, Perth.

76. Cale, D.J., **Halse, S.A.** and Walker, C.D. 2004. Wetland monitoring in the wheatbelt of south-west Western Australia: site descriptions, waterbird, aquatic invertebrate and groundwater data. *Conservation Science Western Australia* **5**, 20-135.
75. Blinn, D.W., **Halse, S.A.**, Pinder, A.M. and Shiel, R.J. 2004. Diatom and zooplankton communities and environmental determinants in the Western Australia wheatbelt: a response to secondary salinization. *Hydrobiologia* **528**, 229-248.
74. Radke, L.C., Juggins, S., **Halse, S.A.**, De Deckker, P. and Finston, T. 2003. Chemical diversity in south-eastern Australian saline lakes II: biotic implications. *Marine and Freshwater Research* **54**, 895-912.
73. **Halse, S.A.**, Ruprecht, J.K., and Pinder, A.M. 2003. Salinization and prospects for biodiversity in rivers and wetlands of south-west Western Australia. *Australian Journal of Botany* **51**, 673-688.
72. Davis, J.A., McGuire, M., **Halse, S.A.**, Hamilton, D., Horwitz, P., McComb, A.J., Froend R.H., Lyons, M. and Sim, L. 2003. What happens when you add salt: predicting impacts of secondary salinisation on shallow aquatic ecosystems using an alternative states model. *Australian Journal of Botany* **51**, 715-724.
71. Sutcliffe, K., Taplin, R., Davis, J.A. and **Halse, S.A.** 2002. Factors affecting the distribution of stoneflies (Plecoptera) in south-western Australia. *Verhandlungen Internationale Vereinigung fur theoretische und angewandte Limnologie* **28**, 1538-1541
70. Pinder, A.M., **Halse, S.A.**, Shiel, R.J., Cale, D.J. and McRae, J.M. 2002. Halophile aquatic invertebrates in the wheatbelt region of south-western Australia. *Verhandlungen Internationale Vereinigung fur theoretische und angewandte Limnologie* **28**, 1687-1694.
69. Pinder, A.M. and **Halse, S.A.** 2002. Two new species of *Ainudrilus* (Clitellata: Tubificidae) from south-western Australia, with notes on *Ainudrilus nharna* Pinder and Brinkhurst. *Records of the Western Australian Museum* **21**, 1-7.
68. Keighery, G., **Halse, S.** and McKenzie, N. 2002. Why wheatbelt valleys are valuable and vulnerable: the ecology of wheatbelt valleys and threats to their survival. In *Dealing with Salinity in Wheatbelt Valleys: Processes, Prospects and Practical Options* (ed. V.A. Read) pp. 1-8. Water and Rivers Commission, Perth (Available on CD).
67. **Halse, S.A.**, Scanlon, M.D. and Cocking, J.S. 2002. Do springs provide a window to the groundwater fauna of the Australian arid zone? In *Balancing the Groundwater Budget: Proceedings of an International Groundwater Conference, Darwin 2002* (ed. D Yinfoo) pp. 1-12. International Association of Hydrogeologists, Darwin (Available on CD).
66. **Halse, S.A.**, Cale, D.J., Jasinska, E.J. and Shiel, R.J. 2002. Monitoring change in aquatic invertebrate biodiversity: sample size, faunal elements and analytical methods. *Aquatic Ecology* **36**, 395-410.
65. **Halse, S.A.** 2002. Diversity of Ostracoda (Crustacea) in inland waters of Western Australia. *Verhandlungen Internationale Vereinigung fur theoretische und angewandte Limnologie* **28**, 914-918.
64. Kay, W.R., **Halse, S.A.**, Scanlon, M.D. and Smith, M.J. 2001. Distribution and environmental tolerances of aquatic macroinvertebrate families in the agricultural zone of south-western Australia. *Journal of the North American Benthological Society* **20**, 182-199.
63. **Halse, S.A.** and McRae, J.M. 2001. *Calamoecia trilobata* n. sp. (Copepoda: Calanoida) from salt lakes in south-western Australia. *Journal of the Royal Society of Western Australia* **84**, 5-11.
62. Davis, J.A., **Halse, S.A.** and Froend, R.H. 2001. Factors influencing biodiversity in coastal plain wetlands of southwestern Australia. In *Biodiversity in Wetlands: Assessment, Function and Conservation*, Vol. 2 (eds B. Gopal, W.J. Junk and J.A. Davis) pp. 89-100. Backhuys, Leiden.
61. Pinder, A.M., **Halse, S.A.**, Shiel, R.J. and McRae, J.M. 2000. Granite outcrop pools in south-western Australia: foci of diversification and refugia for aquatic invertebrates. *Journal of the Royal Society of Western Australia* **83**, 117-129.
60. McKenzie, N.L., **Halse, S.A.** and Gibson, N. 2000. Some gaps in the reserve system of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum Supplement* **61**, 547-567.
- 59*. **Halse, S.A.**, Shiel, R.J., Storey, A.W., Edward, D.H.D., Lansbury, I, Cale, D.J. and Harvey, M.S. 2000. Aquatic invertebrates and waterbirds of wetlands and rivers of the southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum Supplement* **61**, 217-265.
58. **Halse, S.A.**, Pearson, G.B., McRae, J.M. and Shiel, R.J. 2000. Monitoring aquatic invertebrates and waterbirds at Toolibin and Walbyring Lakes in the Western Australian wheatbelt. *Journal of the Royal Society of Western Australia* **83**, 17-28.

57. Smith, M.J., Kay, W.R., Edward, D.H.E., Richardson, K., Papas, P., Pinder, A.M, Cale, D.J, Horwitz, P.H.J., Davis, J.A., Simpson, J.C, Yung, Y.H., Norris, R.H. and **Halse, S.A.** 1999. AUSRIVAS: using macroinvertebrates to assess ecological condition of rivers in Western Australia. *Freshwater Biology* **41**, 269-282.
56. Knott, B. and **Halse, S.A.** 1999. *Pilbarophreatoicus platyarthricus* n. gen., n. sp. (Isopoda, Phreatoicoidea, Amphispodidae) from the Pilbara region of Western Australia. *Records of the Australian Museum* **51**, 33-42.
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Reviewer Credentials Form

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Minimum experience: peer reviewer

Year	Type of Facility, Type of Review	Country & State/Province
1995	Gold Mine, Dam Inspections	Australia, Queensland
2004	Gold Mine, Internal Environmental Audits	Australia, NSW
2005- 2007	Gold / Silver Mines, Internal Environmental Audits	Mexico, Brazil, USA, Canada, Australia

Related Experience

Each peer reviewer must indicate experience relative to the project being peer reviewed

Reviewer	Yrs.	Relevant Position Titles	Types of Operations/Reviews
Jamie Coad	1.5yrs	Goldroom Foreman – (small mine), this also included environmental responsibilities due to me having an environmental degree.	Gold Mine – regular tailings and process water pond inspections for wildlife. This mine was within a known koala habitat and regular monitoring of trees used by koalas was undertaken.
Jamie Coad	2yrs	Manager Environment Health, Safety and Metallurgy	Gold Mine – responsible for implementing wildlife monitoring project on a central discharge tailings dam and process water dam to determine if cyanosis was the likely cause of wildlife fatalities. Also involved in the initiation of the ACMER P58 cyanide project, even though the site did not become members of the project. Responsible for regulatory and corporate reports were written incorporating results from the site cyanide project

Jamie Coad	3yrs	General Manager - Sustainability	Gold / Silver Mines - Inspections of tailings and process water dam reviews to determine whether or not there had been instances of animal deaths at mine sites. These ecological reviews lead to some of the operations beginning regular monitoring of the dams for wildlife and reporting of animal deaths
Jamie Coad		Bachelor of Appl Sc – Natural Resource Management	This is an environmental degree with a focus on wildlife ecology, including environmental chemistry, freshwater ecology, taxonomy and morphology.

Statement of No Conflict

I certify that I have not had any involvement with any aspect of this ACMER project, nor have I within the past year been an employee of the facility, ACMER, parent companies or associated affiliates. Excluding audits and peer reviews, I have not derived more than 30% of my income within the past 5 years from the facility, ACMER, parent companies or associated affiliates. I am familiar with the International Cyanide Code as well as with the protocols developed by the International Cyanide Management Institute for implementation of the Code.

Signed,

Lead Reviewer*

Name

Jamie Coad

Signature



Date

18/2/2010

Reviewer 1

Reviewer 2

Reviewer 3

Reviewer 4

Use additional pages if necessary

*The lead reviewers signature must be certified by notarization or equivalent.