

ENPOINT

Contaminated Land Solutions

Derivation of Risk-Based Criteria: Arsenic in Supernatant

The issue

Enpoint's client were seeking to amend their Environmental Protection Act licence to construct a modified design for the tailings storage facility (TSF) to utilise additional surface area between the cells and the adjacent Waste Dump to facilitate a 10-year extension on the life of mine.

As part of the amendment process the Department of Water and Environmental Regulation (DWER) completed a risk assessment for the activities related to the TSF expansion. An outcome of the risk assessment was that the arsenic concentration in supernatant of the TSF has the potential to cause poor wildlife health or death if the supernatant was ingested by birds or other wildlife. For this reason, DWER added a condition to the licence requiring them to reduce the soluble arsenic concentrations in the supernatant to 0.1mg/L (livestock drinking water trigger value). The concentration of arsenic in the supernatant was 23mg/L. Therefore, treatment of the supernatant would be required, and costs associated with treatment were estimated to be in the order of \$7M/year.

Arsenic exists in the supernatant in the TSF as a result of the weathering of arsenic bearing minerals in the processed ore. Arsenic typically exists in water as two valencies, As^{3+} and As^{5+} where As^{3+} is more toxic than As^{5+} (ANZECC and ARMCANZ, 2000). Analytical results indicated that the predominant species of arsenic in the supernatant is As^{3+} .

The potential for arsenic in the supernatant of the TSF to cause poor wildlife health or death birds or other wildlife was dependent on the concentration in the supernatant and the likely exposure scenarios at the TSF.

The Enpoint solution

Derivation of an alternative trigger value (TV) for arsenic in supernatant that is risk-based would provide a balance between ecological protection and the requirement for further investigation and/or management. This approach was presented to DWER prior to implementing and the approach and methodology for deriving a risk-based TV was agreed upon.

To allow derivation of a site-specific and risk-based TV for arsenic, Enpoint collated and reviewed toxicity data available in the scientific literature for the relevant receptors known / expected to be present at the site to derive an alternative TV that is protective of birds and other wildlife under the known or suspected exposure scenarios at the TSF. The proposed methodology is outlined in Figure 1:



Figure 1 Schematic of the Method for Deriving the Trigger Value

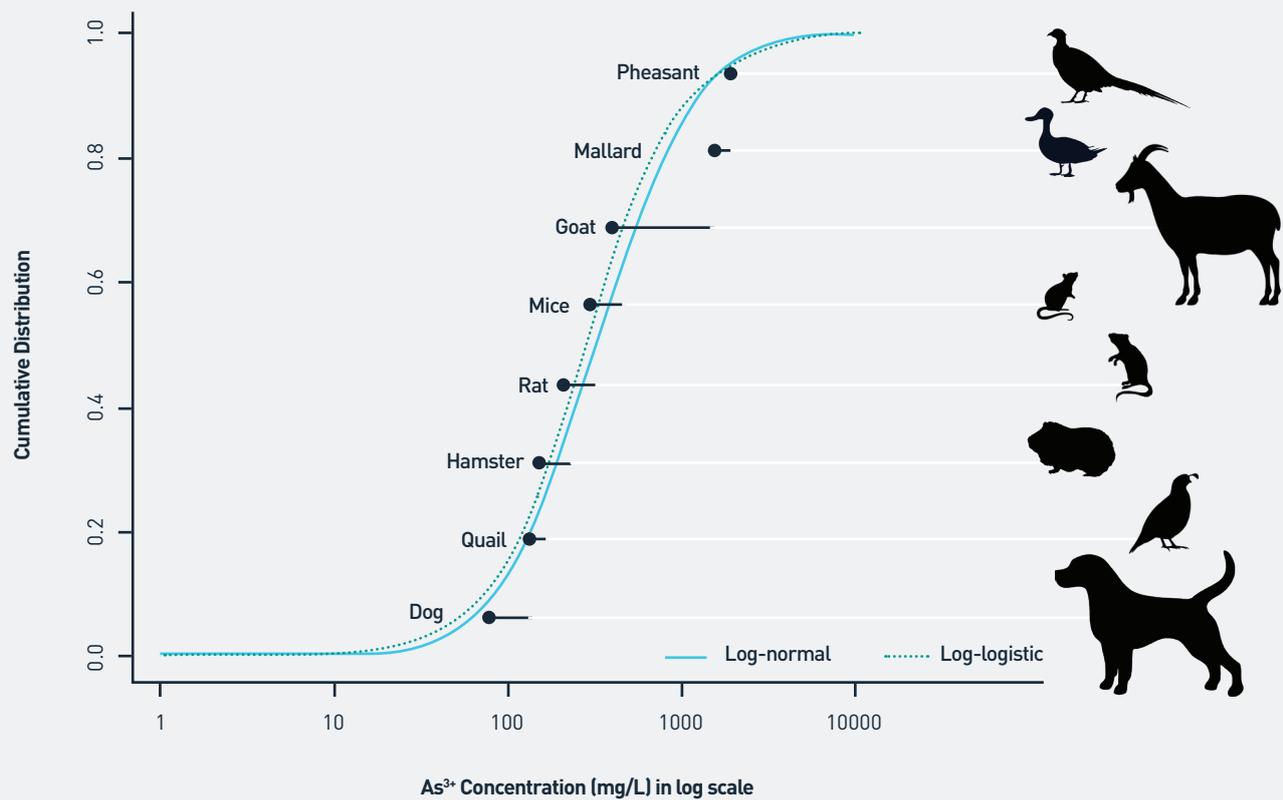


Figure 2 Species Sensitivity Distribution for As^{3+} in Supernatant

(From previous page)

An As^{3+} concentration of less than 27 mg/L in the supernatant of the TSF is therefore unlikely to cause unacceptable effects to birds and mammals even if they were to drink the supernatant at a daily drinking water consumption rate. The concentration is expected to pose even lower risks to birds and mammals under the more likely incidental exposure scenario. A concentration of 54 mg/L may represent an upper bound to any trigger level to protect dogs that are known to frequent the site from time to time.

The outcomes

The TSF is intended to manage mine tailings and resulting supernatant. The TSF is not intended to support any ecological function or provide a drinking water source for wildlife or livestock. However, wildlife and/or livestock are known to frequent the facility given the facility is located within wildlife habitat and within a pastoral lease.

The assessment conducted by Enpoint identified that wildlife, namely birds and mammals do visit the TSF on an occasional basis. Livestock visitation is rare. Exposure to supernatant in the TSF by individual birds and mammals was therefore deemed to be short-term in nature and most likely to result from incidental ingestion. Drinking of supernatant by wildlife or livestock was not observed by the client and therefore was considered unlikely due to poor water quality due to salinity and alternative bore fed water sources.

The risk-based trigger value was derived in accordance with national guidance on ecological risk assessments. From the assessment, an arsenic concentration of less than 27 mg/L was considered unlikely to cause poor wildlife health or death under the exposure scenarios known or suspected to occur at the TSF. Given this value was derived for As^{3+} , the most toxic valency of arsenic, the value is also considered applicable to total arsenic.

Meet the consultants



Jeff Shivak
Principal Environmental Scientist

Perth Office
Suite 8, Level 1
19 Essex Street
Fremantle WA 6160
T 08 9336 4709
Contact Jeff Shivak
info@enpoint.com.au



Matt Jones
Principal Environmental Scientist

South West WA Office
Suite 17, 31 Dunn Bay Road
PO Box 731
Dunsborough WA 6281
T 08 9755 3698
Contact Matt Jones
info@enpoint.com.au