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Project Manager
Proposed Regulatory Amendments to Categories 63-66, 89
Department of Water Environmental Regulation
Locked Bag 33
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Re: Consultation Paper:

Amendments proposed following the decision on *Eclipse Resources Pty Ltd v The State of Western Australia [No.4]* (2016) WASC 62

1. BACKGROUND

Following Justice Beech's decision in *Eclipse Resources Pty Ltd v The State of Western Australia [No 4]* (2016) WASC 62, handed down on 9 March 2016 in the Supreme Court of Western Australia, the Department of Water and Environmental Regulation (DWER) proposes amendments to:

- The description of category 63, 64, 65 and 66, and 89 of Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations), and
- The *Landfill Waste Classification and Waste Definitions 1996 (as amended December 2009)* (Waste Definitions).

DWER subsequently published a Consultation Paper (the paper) titled "Amendments proposed following the decision on *Eclipse Resources Pty Ltd v The State of Western Australia [No.4]* (2016) WASC 62" in November 2017. The release of this paper provides an opportunity for government and stakeholders to work together to ensure that these amendments deliver their intended outcomes, and to identify and resolve any unintended consequences of these amendments prior to them taking effect.

Members of MBS Environmental's geoscience team collectively have many years' experience in assessment of contaminated soils and waste materials, including various mineral processing residues that have potential as replacements for increasingly scarce basic raw materials (BRMs), or materials with properties suitable for addressing important environmental issues, notable eutrophication of surface waters and groundwater resources in the south west of WA. This letter provides advice based on this collective experience to assist DWER achieve the objectives of the proposed amendments by avoiding unindented adverse outcomes that may arise by implementation of the paper in its current form.

2. MBS ENVIRONMENTAL RESPONSE

2.1 GENERAL COMMENTS

Western Australia faces significant challenges to address two important emerging environmental issues that underlie the basis for publication of this paper:

- Decreasing access to supply of inexpensive, natural BRM including sand, gravel and lime-related materials as a consequence of the predicted expansion of the Perth Metropolitan Area (particularly within the Peel Region), thereby sterilising access to several major deposits.
- A need for very large volumes of 'clean fill' or 'uncontaminated fill' materials to enable urban development of rural areas with high groundwater tables.
- Current practices of disposal of very large volumes of potentially useful industrial residues to landfill and other permanent above ground residue storage facilities. Continuing these practices will make it very difficult for WA to meet its waste reduction strategic objectives outlined in the Western Australian Waste Strategy (Waste Authority 2012).

MBS Environmental fully supports the underlying intent of the paper to clarify definitions of "waste", "uncontaminated fill" and "clean fill" proposed in the paper. Consequently, MBS Environmental offers no comment on the following sections of the paper:

- Introduction.
- Legislative Context.
- Proposed Amendments.
  - Amendments to category 63 to 66, and 89 of the EP Regulations.
  - Amendments to category 63 to 66, and 89 of the EP Regulations.
  - Next steps.
- References.
- Appendix A - Environmental Protection (Amendment) Regulations 2017.

Whilst noting that Appendix B maximum concentrations apply to 'uncontaminated fill' and that 'clean fill' sourced from undisturbed soil areas may not therefore need to be assessed against these levels, MBS Environmental considers several maximum concentrations (thresholds) of chemical substances listed in Table 1 of Appendix B to be unnecessarily conservative based on natural soil concentrations given soils/reclaimed soils will typically still comprise a large percentage of 'uncontaminated fill'. In some cases, this would result in an unintended perverse outcome of several natural regolith materials (notably subsoils of Bassendean and Spearwood sands) failing to comply with these criteria for 'uncontaminated fill'. Comments relating to these parameters are presented in Section 2.2.

2.2 SPECIFIC COMMENTS FOR MAXIMUM SOLID CONCENTRATIONS (MG/KG)

2.2.1 Chromium III

The paper proposes a maximum (dry weight) concentration for chromium III (trivalent chromium) of 30 mg/kg. Chromium is a relatively low toxicity and naturally abundant element, with an estimated average crustal abundance of 100 mg/kg (Bowen 1979), with higher concentrations often associated with mafic and ultramafic geologies. The proposed value for chromium is lower than those proposed for copper (50 mg/kg), lead (110 mg/kg), molybdenum (40 mg/kg), tin (50 mg/kg) and complexed cyanide (50 mg/kg), neither reflecting their relative natural abundances nor environmental toxicities.

MBS Environmental recommends the threshold maximum concentration for chromium be increased to 400 mg/kg, corresponding to the now superseded DWER (formerly DEC) soil Ecological Investigation Limit (EIL) for contaminated site assessment (DEC 2010) and more consistent with natural concentrations of chromium in mafic and ultramafic lithologies (200 to 2,000 mg/kg, AIMM 2001). MBS Environmental notes there are useful clay materials in the Darling Range formed by weathering of mafic intrusions and therefore expected to be naturally elevated in chromium.

2.2.2 Nickel

The paper proposes a maximum (dry weight) concentration for nickel of 10 mg/kg. Nickel is a relatively abundant element, with an estimated average crustal abundance of 80 mg/kg (Bowen 1979), with higher concentrations often associated with mafic and ultramafic geologies (AIMM 2001). The proposed value for nickel is lower than those proposed for silver (20 mg/kg), cobalt (15 mg/kg), copper (50 mg/kg), lead (110 mg/kg), molybdenum (40 mg/kg), tin (50 mg/kg) and complexed cyanide (50 mg/kg), neither reflecting their relative natural abundances nor environmental toxicities.

MBS Environmental recommends the threshold maximum concentration for nickel be increased to 60 mg/kg, corresponding to the now superseded DWER (formerly DEC) soil Ecological Investigation Limit (EIL) for contaminated site assessment (DEC 2010) and more consistent with natural concentrations of nickel in mafic and ultramafic lithologies (150 to 2,000 mg/kg, AIMM 2001). MBS Environmental notes there are useful clay materials in the Darling Range formed by weathering of mafic intrusions and therefore expected to be naturally elevated in nickel.

2.2.3 Zinc

The paper proposes a maximum (dry weight) concentration and leachate concentration for zinc of 50 mg/kg. Zinc is a relatively abundant element, with an estimated average crustal abundance of 75 mg/kg (Bowen 1979), with higher concentrations in fertilised sandy soils. The proposed maximum concentration value for zinc is lower than those proposed for lead (110 mg/kg), and complexed cyanide (50 mg/kg), neither reflecting their relative natural abundances nor environmental or human health toxicities.

MBS Environmental recommends the threshold maximum concentration for zinc be increased to 60 mg/kg, corresponding to the now superseded DWER (formerly DEC) soil Ecological Investigation Limit (EIL) for contaminated site assessment (DEC 2010) and more consistent with natural concentrations of zinc in mafic and ultramafic lithologies (50 to 100 mg/kg, AIMM 2001).

2.2.4 Asbestos

The adoption of 0.001% w/w asbestos is consistent with current practice for construction and demolition and contaminated sites (DoH, DWER and NEPC). It is noted however that the method upon which this is based (AS 4964-2004) and for which laboratories are accredited is for soils (not construction/demolition waste mixed with soils) and in particular to a limit of reporting of 0.01% w/w asbestos. It is suggested that advice be sought from laboratories involved in testing if development of a new Australian Standard is required is to cover this extension of method beyond its scope (and possibly avoid legal challenges).

2.2.5 pH

The paper proposes a pH range of the material of 6 to 9 pH units, and a range of ASLP pH values of 6.5 to 8.5. By definition, pH is a solution parameter (corresponding to the activity of the hydrogen ion, H^+, in solution) and therefore has no meaning when applied to a solid material. In practice, pH is measured in the laboratory by preparing an extract of an air dry, sieved solid in either reagent water or a dilute electrolyte solution (such as 0.01 M $CaCl_2$ or 1 M KCl). The resulting pH values vary depending on the solid to solution extraction ratio, extraction time and concentration of electrolyte. MBS Environmental recommends adoption of a standard extraction method for measuring pH. Options include:

- ASLP (1:20 solid to solution ratio using reagent water) – in which case the definition against the soil column is redundant or at least should match the ASLP column.
- 1:5 solid to solution ratio using reagent water, Rayment and Lyons (2011) Method 4A1.

MBS Environmental considers the proposed pH ranges to be too restrictive. For example, pH values of natural Bassendean sand subsoil, which is currently a major source of clean fill material, are typically below 5.5 pH units and therefore the material was not be classified as 'uncontaminated fill' according to the proposed criteria. On the

other hand, calcareous Spearwood sand subsoils, the dominant source of clean fill material on the Swan Coastal Plain, occasionally records pH values greater than 9.0, exceeding the proposed criteria.

MBS Environmental recommends the pH criteria, currently 6 to 9 in the maximum concentration column and 6.5 to 8.5 in the leaching test (ASLP) column, be extended to a range of 5.0 to 9.5 pH units.

2.3 COMMENTS FOR LEACHING TEST CONCENTRATIONS

The maximum concentrations in the ASLP leachates have generally been set by using the aquatic trigger values for 95% protection (slightly-moderately disturbed ecosystems, ANZECC 2000) or the Australian Drinking Water Guideline (ADWG) value (ADWG 2011). This approach has some general potential issues:

- The source guideline values (ANZECC/ADWG) are for clean waters and are often at the limits of method capabilities – when applied to soil extracts which contain multiple possible interferences such as extracted organic material and dissolved iron, the laboratory limits of reporting are normally raised and may no longer meet the requirements. It will also lead to potential false positives and/or additional expense if more sensitive methods are needed.
- The source values (ANZECC/ADWG) are established for concentrations at the receptor endpoint – applying to a 1:20 extract of the material in mostly urban areas does not allow for any attenuation of concentrations from source to possible receptor and is considered overly conservative in general. While a 'one case fits all' approach is convenient to suit protection of both aquatic systems and drinking water supplies, it is primarily the latter which is probably more applicable for the majority of applications in highly disturbed urban environments where such material is used.

Given even marginal attenuation, interferences and for consistency, the 'non potable groundwater use – NPUG guidelines (DWER 2014 – generally ten times the human health drinking water guideline) are considered a more generally appropriate basis for most ASLP threshold values where one is established with the exception of a few species such as copper which is significantly more toxic in the aquatic environment than to human health. Persistent pollutants (e.g. DDT) or those which can bio-accumulate may also require lower thresholds which ignore attenuation allowance of adopting NPUG. MBS Environmental recommends this as a general approach with some specific comments for particular parameters outlined below.

2.3.1 Aluminium

The paper proposes a maximum leachate (ASLP method) concentration of aluminium of 55 µg/L, which corresponds to the ANZECC 2000 trigger value for aluminium for 95% protection of species in slightly to moderately disturbed freshwater aquatic ecosystems with pH values greater than 6.5. MBS Environmental advises that many natural regolith materials, especially surface soils of Bassendean and Spearwood sands, would not comply with this value as a consequence of soluble aluminium being complexed with other natural constituents of soil including organic matter, fluoride and sulfate ions. Such complex aluminium ions are considered significantly less toxic than the hydrated aluminium ion, for which the ANZECC 2000 trigger value is based upon.

In the absence of a health based drinking water guideline, MBS Environmental recommends the threshold leachate concentration for aluminium be increased to 200 µg/L, corresponding to the aesthetic guideline for human drinking water (ADWG 2011).

2.3.2 Cobalt and Copper

Both these elements have proposed thresholds of 1 µg/L which is noted as being equal to typical limits of reporting by most laboratories using routine equipment (with corresponding uncertainty). Copper is very commonly present around this concentration in groundwaters of the Swan Coastal Plain and almost all 1:20 extracts of soils and especially those mixed with demolition waste would be expected to exceed this concentration. The human health drinking water guideline of 1,000 µg/L for copper is conversely considered inappropriate for protection of aquatic systems (none established for cobalt). On the basis of an assumed minimum tenfold

attenuation factor (consistent with NPUG adoption) from ANZECC 95% trigger values, suggested threshold values are 14 µg/L for copper and 10 µg/L for cobalt.

2.3.3 Chromium (III) and Chromium (VI)

Chromium(VI) while toxic is highly reactive and requires particular conditions to persist to exist - including a lack of organic matter or dissolved iron in groundwater which is not the case in the Swan Coastal Plain. The use a threshold value of 1 µg/L (ANZECC 95%) is considered overly conservative and as this is below the routine limit of reporting by standard colourimetric methods, will require more expensive chromatography methods for determination and routine screening of these materials. Chromium(III) is normally insoluble at circum-neutral pH ranges and is not considered particularly toxic. MBS Environmental recommends either 10 µg/L (10 times ANZECC 95%) or 50 µg/L (Australian Drinking Water Guideline) as a threshold value for chromium(VI) as being protective of health/environment and more practical in application. Chromium(III) is not considered particularly relevant and may not require a threshold value at all or otherwise 270 µg/L is more appropriate (tenfold the ANZECC marine aquatic).

2.3.4 Mercury

The threshold suggested of 0.05 µg/L is below any currently established environmental or drinking water guidelines for Australia. It will also require modified laboratory methods for many laboratories to achieve. A suggested threshold consistent with previous arguments would be 0.6 µg/L (ten times ANZECC 99% protection) which is also similar to the ADWG of 1 µg/L.

2.3.5 Molybdenum

The threshold suggested of 0.035 µg/L is unclear as to how this is derived. Molybdenum (like chromium(III)) also does not have significant mobility or toxicity in the environment. A suggested threshold consistent with previous arguments for even marginal attenuation would be 500 µg/L (NPUG, ten times ADWG).

2.3.6 Cyanide

The suggested threshold of 5 µg/L is below the ANZECC 2000 freshwater aquatic guideline of 7 µg/L and below the routine limit of reporting of free cyanide of 10 µg/L for most laboratories. Cyanide is highly unlikely to be present in material other than mine process wastes and will normally attenuate rapidly in non-saline groundwaters with biological activity. A threshold value of at least 80 µg/L, equal to the ADWG is suggested.

2.3.7 Fluoride

The threshold value suggested of 120 µg/L (0.12 mg/L) is unclear as to derivation/source. Dissolved fluoride in groundwater in areas of the Swan Coastal Plain and south west WA range up to the level of the ADWG values of 1,500 µg/L from natural sources. Soluble fluoride is often present complexed with aluminium – high concentrations of fluoride will normally therefore also exceed aluminium threshold values. The long-term irrigation guideline for fluoride is 1,000 µg/L (DWER 2014) while the NPUG value is 15,000 µg/L. A suggested threshold equal to the ADWG of 1,500 µg/L is therefore suggested as a more appropriate threshold value for protection of groundwater uses.

2.3.8 Ethylbenzene and Toluene

The threshold values suggested of 0.005 µg/L for ethylbenzene and 0.18 µg/L for toluene are unclear as to how they are derived, but possibly based on aesthetic not health based guidelines. Suggested thresholds consistent with health based ADWG (as for benzene) would be 0.3 µg/L for ethylbenzene and 0.8 µg/L for toluene.

2.3.9 Aldrin plus Dieldrin (Sum)

The threshold suggested of 0.001 µg/L is unclear as to how this is derived and is below the enhanced (additional cost) reporting levels of most laboratories for analysis of drinking waters (0.01 to 0.05 µg/L). In soil extracts, such levels would be even harder to achieve given interferences in the matrix. A more consistent approach would be to set this persistent chemical at the ADWG concentration of 0.3 µg/L.

2.3.10 Zinc

The paper proposes a leachate concentration for zinc of 50 mg/kg and 10 µg/L respectively. The maximum leachate concentration corresponds approximately to the ANZECC 2000 trigger value for zinc for 95% protection of species in slightly to moderately disturbed freshwater aquatic ecosystems with soft water.

MBS Environmental recommends that the threshold leaching test concentration be increased to 40 µg/L, corresponding to the ANZECC 2000 trigger value for zinc in hard water (for 95% protection of species in slightly to moderately disturbed freshwater aquatic ecosystems).

3. REFERENCES

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If you have any queries regarding this submission, please contact us at MBS Environmental (phone 08 9226 3166).

Yours sincerely
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