ChemCentre Comments on DWER Consultation Paper

Amendments to Schedule 1 of the *Environmental Protection Regulations 1987* – November 2017

Established in 1890, ChemCentre is Western Australia's leading chemical and forensic science service provider. We play a key role in matters of public and environmental health, justice, safety and security and provide high quality, independent chemical information, applied research, expert opinions, advice, investigative support and complex analytical services to government agencies, industry and research groups. We apply technical knowledge to practical problems to achieve effective outcomes for communities, government, and industry. These unique skills have created an organisation with an uncompromising attitude to quality and our experience in providing qualitative and quantitative data will stand up to legal scrutiny and assist government in addressing regulatory issues.

ChemCentre appreciates the opportunity to comment on this paper and welcomes all queries that may be raised from the items listed below.

Amendments to category 63 to 66, and 89 of the EP Regulations
ChemCentre does not have any comments on the Amendments to Categories, 63 to 66 and 89 of the EP Regulations.

Amendments to Waste Definitions
Particularly: The chemical criteria that need to be met to satisfy the definitions for 'uncontaminated fill' and 'clean fill' as proposed for inclusion in the Waste Definitions document, Appendix B, Pages 9-11 including Table 1 of the Consultation paper.

Testing Regime: The stated requirements for testing of waste materials such as clean fill and uncontaminated fill is to determine total composition of metals, metalloids, and organic compounds with follow up as required by performing ASLP tests (note that currently AS4439.1, .2 and .3 are all listed as "Withdrawn"). The ASLP tests currently applied in Australia were originally based on the Toxicity Characteristic Leaching Procedure (TCLP) developed by the United States Environmental Protection Agency (US EPA), a procedure designed to simulate leaching of industrial wastes under acidic conditions within a putrescible landfill.

The main limitation of the ASLP is that they only provide leaching data for one pH value chosen out of two or three, and therefore may not provide information on the long-term leaching behaviour of the material. Additionally, the tests are biased for acidic conditions which may give conservative values for constituents present as cations in solution, and which also may underestimate the concentrations of anionic substances under neutral to alkaline pH conditions as occurs in Western Australian soils. Leaching tests need to be done under the full range of pH conditions that waste materials experience to provide a higher level of confidence in predicting contaminants in leachate .

Other limitations of the current ASLP test are:

- it does not consider how the concentrations of constituents in leachate will vary as the liquid to solid ratio changes and
- it provides no information about the release rate of constituents from solid wastes.

This information would be required to determine the mass flux of contaminants that could be leached from solid waste materials into the environment.

New tests are now available in Western Australia to determine how leaching varies with pH and the liquid-to-solid ratio. These tests were developed and adopted in the EU as part of a process of harmonisation of test methods across member countries, and in 2012, these tests were adopted and updated by the US EPA to form part of a new Leaching Environmental Assessment Framework (LEAF).

LEAF consists of four separate leaching test procedures that can be used individually or as a combination of tests. These are:

- Test Method 1313, determines how liquid-solid partitioning varies with the pH of the leaching solution using a parallel batch extraction procedure;
- Test Method 1314, determines how liquid-solid portioning varies with varying liquid to solid ratios using an up-flow percolation column procedure;
- Test Method 1315, determines mass transfer rates of chemical constituents in leachate from monolithic and compacted granular materials (e.g. construction materials) using a semi-dynamic tank leaching procedure; and
- Test Method 1316, determines how liquid-solid partitioning varies with the liquid to solid ratio using a parallel batch extraction procedure.

Detailed information on all of these test methods can be found at www.vanderbilt.edu/leaching/leaching-tests/.

LEAF Test Method 1313 looks at the soil behaviour over the range pH2 to pH13, which is superior to the ASLP test done at a single pH. Test Method 1313 therefore provides more comprehensive data than the current ASLP test.

ChemCentre is currently running an MRIWA and industry funded project, "*Establishing Leaching Environmental Impact Assessment Tools in the Development of a WA Framework for By-product Re-use and Classification*", that will better inform the development of LEAF guidelines and frameworks for re-use and classification of waste derived materials.

ChemCentre recommends that the LEAF tests, be included for determining the leaching potential for chemical constituents of concern, as the need arises following results obtained from total chemical composition and with consideration of the expected disposal environment(s).

Criteria: Clean Fill (b) does not contain any Acid Sulfate Soil (ASS): Bassendean Sand would be identified as an ASS with the Suspension Peroxide Oxidation and Combined Acidity and Sulfur (SPOCAS) method due to acidity generated by oxidation with hydrogen peroxide. This may not be the case if the chromium reducible sulfur (CRS) method was used, as this measures sulfide content

and existing, not potential acidity. Assessment of the amount of acid sulfate soil present in a sample will need to account for the two weaknesses in the testing regimes, namely:

- That the CRS method will determine sulfide content and existing acidity, it will not indicate potential acidity due to oxidation and may result in an underestimate of potentially acid-forming soil and
- That the SPOCAS method will highlight potential acid forming characteristics due to sulfide oxidation and metal hydrolysis but will over estimate potential acidity in soil with high organic content.

What is missing from the proposed guidelines is criteria for eliminating potential ASS as clean fill. A sulfide content of 0.03% and/or an acid producing potential of 18 moles H^+ per tonne are generally accepted maximum levels for WA soils. Caution must be exercised with Bassendean Sand as fill. This soil exhibits acidity due to iron and organic matter despite having a sulfide content <0.03%. If Bassendean Sand has <0.03% sulfide but a pH_{fox} (field peroxide pH) of <3, it is to be treated by neutralisation as if it had a sulfide content of 0.03%.

ChemCentre recommends that the method for determination of ASS take into consideration sulfide and organic content and existing and potential acidity. If the CRS method is used, it is recommended that a pH_{fox} test also be carried out to confirm soils <0.03% sulfide will not generate unacceptable levels of acidity.

ChemCentre appreciates that the purpose of this document is to determine the levels appropriate for storage outside of a registered waste disposal facility but feel the following are worth noting. *Metals Concentration in Table 1*: The proposed guidelines for maximum concentrations of metals in clean fill are similar to Landfill Class I guidelines (2001). This raises the question as to why a separate but similar set of guidelines for metal concentrations are required in addition to the Landfill Class I classifications. In general, the proposed limits are slightly higher for metals with the exception of lead. The proposed limit is 110 mg/kg which is higher than Landfill Class I (2 mg/kg without testing for leachable lead). In contrast, the proposed leachate concentration of 3 µg/L lead is much lower than for leachate from Class I landfill at 100 µg/L lead. The proposed leachate concentrations appear to use the very conservative fresh water guidelines (ANZECC & ARMCANZ 2000) as a starting point. A Table with the comparative data is given in Appendix A of this document. Values in Red are the maximum allowable concentrations in the solid waste material provided the concentrations in the leachates do not exceed the maximum allowable concentrations obtain by ASLP testing. If not tested for leachate concentrations, the lower value applies.

ChemCentre recommends that the reason for the proposed guideline values be re-evaluated to allow for a single classification system, ideally the Landfill Class 1 Limits.

pH Range in Table 1: Most WA soil types will have a pH between 4.5 and 9.5 (if determined using a water extract). A soil with a pH of 5 or less will result in levels of aluminium and manganese that may be toxic to plant growth. The optimal range for plant growth is pH 5.5 to 8.0. Appendix B of the DWER paper specifies uncontaminated fill needs to have a Leaching Test pH between 6.5 and 8.5. In this case Bassendean Sand would not meet the definition of **uncontaminated fill** as set out in Appendix B, Table 1 of the document. The pH range of 6.5 to 8.5 is the same as the aesthetic limit for drinking water (Australian Drinking Water Guidelines 6, 2011, NH &MRC) and is similar to

the range for protection of aquatic ecosystems (pH 6.5 to 9). The lower pH limit appears conservative in the case of soils. ChemCentre proposes a range of 5.5 to 8.5, this lower pH is acceptable for plant growth without causing acidification of ground water and allows the use of more soils as fill.

ChemCentre recommends that the pH range be widened from 6.5-8.5 to 5.5-8.5 to accommodate WA soils.

Organic Compounds in Table 1: Hydrocarbons

ChemCentre supports the move towards the more unified NEPM fractions, rather than the legacy aliphatic/aromatic levels present in the Landfill Waste Classification Guidelines. The new NEPM fractions could be used in these Waste Classification, with the proviso that (like the NEPM) the hydrocarbons are 'typical', as defined by National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM), Volume 2, Schedule B1, Section 2.4.5.

> *Where there is reasonable doubt as to the nature of the contamination, the sample may be subjected to a silica gel clean-up and analysed by gas chromatography mass spectrometry (GC-MS) (or other appropriate analytical method) to assist with the identification of contamination of petroleum origin. In these cases, an analyst report should be obtained with an interpretation of the chromatogram and the nature and extent of contamination present in the sample.*

Similar sentiments are expressed in the ASC NEPM Volume 2, Schedule B1, Section 2.4.13, and Volume 4, Schedule B3, Section 10.2.7.

ChemCentre recommends the hydrocarbon component of Waste Classification be amended to align with the new NEPM hydrocarbon definition used in the proposed Waste Definition.

Organic Compounds in Table 1: Styrene

Styrene is an important component of the Waste Classification Guidelines, but is missing from the revised Waste Definitions. Styrene is a breakdown component of petroleum-derived polystyrene plastics from products as diverse as pipework, packaging material and Styrofoam cups.

ChemCentre recommends that styrene be included in the Waste Definition guidelines.

Organic Compounds in Table 1: Benzene

Benzene is a known carcinogen and is listed in the Table, the acceptable limit for this compound is 950 µg/L in the ANZECC guidelines, the value listed in the guidelines is 1 µg/L, these values do not appear to be consistent.

ChemCentre recommends that current limits for Benzene be checked against other relevant guidelines e.g. ANZECC.

Appendix A **Comparison of Proposed Limits with Existing Criteria**

Parameter	Maximum Concentrations mg/kg dry				ASLP ug/L	
	Proposed	Landfill Class 1* (2001)	EIL (2010)	HIL (2010) Residential	Proposed	Landfill Class I (2001)
Aluminium					55	
Antimony	20			31	3	
Arsenic	20	14 **(500)**	20	100	10	500
Barium	200		300	15,000		
Beryllium	2	2 **(100)**		20		100
Cadmium	1	0.4 **(100)**	3	20	0.2	100
Chromium III	30		400	120,000	10	
Chromium VI	1	10 **(500)**	1	100	1	500
Cobalt	15		50	100	1	
Copper	50		100	1,000	1	
Lead	110	2 **(1,500)**	600	300	3	500
Manganese	500		500	1,500	500	
Mercury (inorganic)	0.5	0.2 **(75)**	1	15	0.05	10
Methylmercury				10		
Molybdenum	40	10 **(1,000)**	40	390	35	500
Nickel	10	4 **(3,000)**	60	600	10	200
Selenium	1	2 **(50)**			5	500
Silver	20	20 **(180)**			0.05	1000
Thallium	1				0.8	
Tin (inorganic)	50		50	47,000		
Uranium	25				0.5	
Vanadium	25		50	550		
Zinc	50		200	7,000	10	
Sulfate	2500		2000			
Cyanide (complexed)	50	16 **(1,250)** total	50		5asCN	800total
Cyanide (free)	10		10			
AmmoniaasN					400	
Fluoride	400	300 **(10,000)**			120	15,000
Total nitrogen					2000	
Total phosphorus					200	

Parameter	Maximum Concentrations mg/kg dry				ASLP ug/L	
	Proposed	Landfill Class I* (2001)	EIL (2010)	HIL (2010) Residential	Proposed	Landfill Class I (2001)
Benzene	0.5	0.2 **(18)**	1		1~	100
Toluene	10	160 **(158)**	3		180	8,000
Ethylbenzene	2	60 **(1080)**	5		5	3,000
Xylene	2	120 **(100)**	5		600	6,000
Naphthalene	3					
PAH	300	N/A **(100)**				
Phenol	1				320	
Cresols		400 **(7200)**			2	20,000
PCB	1		1			
Aldrin + dieldrin	1	N/A **(50)**			0.001	3
DDT+DDD+DDE	3	N/A **(1,000)**	1		0.036	200

~ Benzene is 950 ug/L in the ANZECC guidelines. The current value is 1 µg/L, is this correct?

EIL = Ecological Investigation Limits (*Assessment Levels for soils, sediment and water, February 2010, Contaminated Sites Management Series, Department of Environment and Conservation)*
HIL = Health Investigation Limits. Levels based on land use with Class A being standard residential, the most stringent category**.** *(Assessment Levels for soils, sediment and water, February 2010, Contaminated Sites Management Series, Department of Environment and Conservation).*
Landfill Class defined by the maximum allowable contaminant concentrations that can be accepted taking into consideration the construction of the landfill site. Class I has the lowest acceptable contaminant concentrations (*Guidelines for Acceptance of solid waste to landfill, January 2001, Department of Environmental Protection*).

ASLP = Australian Standard Leach Procedure. For Class I, leachate concentrations stated are ten times the Australian Drinking Water Guidelines.

* Under maximum concentrations (mg/kg) listed under Landfill Class I, the values in red parentheses are the maximum allowable concentrations in the solid provided the concentrations in the leachates do not exceed the maximum allowable leachate concentrations obtain by ASLP testing. If not tested for leachate concentrations, the lower value applies.