Draft Standard for Leach Tests & Risk Profiling of Hazardous Waste

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The waste management industry in South Africa is a dynamic, continually evolving entity. Through prudent government leadership it is being steered toward a situation where it can successfully respond to ever more stringent environmental challenges.

The legislation reprinted here will have far reaching consequences on the waste industry, and by default, on every South African.

But its implementation will not be easy.

It will make demands of all stakeholders, from the waste generator to those in local government tasked with overseeing delivery and compliance.

A task made easier with the right partners.

The operational divisions that make up Interwaste (Pty) Ltd allow the company to present itself as a one-stop holistic environmental services supplier.

From waste collection and treatment to recycling and resource reutilisation.
From landfill facility construction and management to site clearing and the rehabilitation of polluted land.

The fact that Interwaste has been promoting these proposed strategies as the basis of its' operational vision for many years reinforces the companys' claim to being at the forefront of waste management development in South Africa.

This booklet should prove of interest and assistance to every waste generator. Interwaste can assist should you need further information on any general or specific area relating to waste management in southern Africa.

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DRAFT STANDARD FOR LEACH TESTS AND RISK PROFILING OF HAZARDOUS WASTE

GENERAL NOTICE

NOTICE…..OF 2010

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 of 2008)
DRAFT STANDARD FOR LEACH TESTS AND RISK PROFILING OF HAZARDOUS WASTE

I, Buyelwa Sonjica, Minister of Water and Environmental Affairs, intend setting a national Standard for Leach Tests and Risk Profiling of Hazardous Waste under Section 7(1)(a) and 7(1)(c) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) as set out in the Schedule hereto.

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BUYELWA SONJICA
MINISTER OF WATER AND ENVIRONMENTAL AFFAIRS

SCHEDULE

NATIONAL STANDARD FOR LEACH TESTS AND RISK PROFILING OF HAZARDOUS WASTE

CONTENTS

1. ASSESSMENT

(1) In terms of Regulation 12(1) of the National Waste Classification and Management Regulations, 2010, the potential level of risk associated with disposal of hazardous wastes must be determined by analysing the total- and leachable concentrations of contaminants in a waste, and the results assessed against three levels of threshold limits for Leachable- and Total Concentrations, which in combination, determines the Risk Profile of the waste.

(2) In terms of this Standard:

(a) Leachable concentration thresholds = South African Standard Leaching Procedure (SASLP) values = SASLP0, SASLP1 and SASLP2.

(b) Total concentration thresholds = South African Standard Total Concentration (SASTC) values = SASTC0, SASTC1 and SASTC2.

(c) LC = Leachable concentration (mg/l) of a specific contaminant in the waste, which is compared with SASLP threshold values.

(d) TC = Total concentration (mg/kg) of a specific contaminant in the waste, which is compared with SASTC threshold values.

(3) Waste Risk Profiling will involve the identification of contaminants likely to be present in the waste, as well as sampling and analysis for each of the contaminants specified in Section 3 of this Standard. Appropriate methods must be used to determine the TC of contaminants, and the LC of contaminants must be determined as specified in Section 2.

2. LEACH TESTS

(1) The leachable concentration (LC) of contaminants specified in Section 3 that are present in the waste must be determined using the Australian Standard Leaching Procedure (ASLP). The leaching solution that is selected will depend on the nature of the waste:

(a) Putrescible wastes or waste to be disposed of with putrescible waste: A 0.1M acetic acid pH 5.0 or pH 2.9 solution depending on the acid neutralisation capacity of the waste must be used.

(b) Waste to be co-disposed with non-putrescible material: A basic 0.1M sodium tetraborate decahydrate solution of pH 9.2 ±0.1 must be used (alkaline test identifies contaminants that are leached at higher concentrations at high pH).

(c) Waste that is to be left undisturbed on-site, or to be dispersed over land without confinement, or non-putrescible material, e.g. a mono-disposal scenario: Reagent water must be used (also relate to contaminated land assessment; in-situ).

(2) If the total concentration (TC) of a contaminant is less than twenty (20) times the lowest leachable concentration threshold specified in Section 3 of this Standard (i.e. TC < 20 x SASLP0), the LC of the contaminant does not have to be determined.

(3) Any existing data on leachable concentrations for contaminants in wastes, which have been determined through the leach test criteria in terms of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (2nd Edition; DWAF Waste Management Series, 1998), may be utilised for Waste Risk Profiling for a period not exceeding one (1) year from the date of publication of this Standard.

3. SASLP AND SASTC THRESHOLD VALUES

(1) South African Standard Leaching Procedure (SASLP) and Total Concentration (SASTC) Threshold Values for Waste Risk Profiling and Assessment of Hazardous Waste Disposal to Landfill.

Contaminants	SASLP0[1] mg/l	SASTC0 mg/kg	SASLP1 mg/l	SASTC1 mg/kg	SASLP2 mg/l	SASTC2[2], mg/kg
Metal Ion Contaminants						
As, Arsenic[3]	0.5	500	1	500	4	2000
B, Boron[4]	25	15000	50	15000	200	60000
Ba, Barium[4]	35	6250	70	6250	280	25000
Cd, Cadmium	0.25	260	0.5	260	2	1040
Co, Cobalt	25	5000	50	5000	200	20000
$Cr_{Total,}$ Chromium Total[5]	5.0	800000	10	800000	40	N/A
Cr(VI), Chromium (VI)[6]	2.5	500	5	500	20	2000
Cu, Copper	50	19500	100	19500	400	78000
Hg, Mercury	0.05	160	0.1	160	0.4	640
Mn, Manganese	20	12750	40	12750	160	51000
Mo, Molybdenum[4]	3.5	1000	7	1000	28	4000
Ni, Nickel	3.5	10600	7	10600	28	42400
Pb, Lead	0.5	1900	1	1900	4	7600
Sb, Antimony[4]	0.5	75	1	75	4	300
Se, Selenium[4]	0.5	50	1	50	4	200
V, Vanadium	5.0	2680	10	2680	40	10720
Zn, Zinc	160	160000	320	160000	1280	640000
Inorganic Anions						
Chloride[7]	5000	N/A	10000	N/A	40000	N/A
Sulphate[7]	10000	N/A	20000	N/A	80000	N/A
NO_3 as N, Nitrate-N[7]	300	N/A	600	N/A	2400	N/A
F, Fluoride[8]	50	10000	100	10000	400	40000
CN^- (total), Cyanide Total	2.5	10500	5	10500	20	42000
Organics						
Benzene	0.01	10	0.02	10	0.08	40
Benzo(a)pyrene	0.035	1.7	0.07	1.7	0.28	6.8
Carbon tetrachloride	0.20	4	0.40	4	1.6	16
Chlorobenzene	5.0	8800	10	8800	40	35200
Chloroform[9]	15	700	30	700	120	2800
2-Chlorophenol	525	2100	30	2100	120	8400
Di (2 ethylhexyl) phthalate[4]	0.50	40	1	40	4	160
1,2-Dichlorobenzene	50	31900	10	31900	40	127600
1,4-Dichlorobenzene	15	18400	30	18400	120	73600
1,2-Dichloroethane	1.5	3.7	3	3.7	12	14.8
1,1-Dichloroethylene	0.35	150	0.7	150	2.8	600
1-2-Dichloroethylene	2.5	3750	5	3750	20	15000
Dichloromethane[4]	0.25	16	0.5	16	2	64
2,4-Dichlorophenol[4]	10	800	20	800	80	3200
2,4-Dinitrotoluene[4]	0.065	5.2	0.13	5.2	0.52	20.8
Ethylbenzene	3.5	540	7	540	28	2160
Ethylenediamine tetra acetic	30	1000	60	1000	240	4000

Contaminants	SASLP0[1] mg/l	SASTC0 mg/kg	SASLP1 mg/l	SASTC1 mg/kg	SASLP2 mg/l	SASTC2[2], mg/kg
acid (EDTA)[4]						
Formaldehyde[4]	25	2000	50	2000	200	8000
Hexachlorobutadiene[4]	0.03	2.8	0.06	2.8	0.24	5.4
Methyl ethyl ketone[4]	100	8000	200	8000	800	32000
MTBE (Methyl t-butyl ether)[10]	2.5	1435	5.0	1435	20.0	5740
Nitrobenzene	1	45	2	45	8	180
PAHs (total)[4, 11]	N/A	50	N/A	50	N/A	200
Petroleum H/Cs, C6 to C9[12]	N/A	325	N/A	650	N/A	2600
Petroleum H/Cs, C10 to C36[12]	N/A	5000	N/A	10000	N/A	40000
Phenols (total, non-halogenated)[4, 13]	7	560	14	560	56	2240
Polychlorinated biphenyls	0.025	3	0.05	3	0.2	12
Styrene[4]	1.0	120	2	120	8	480
1,1,1,2-Tetrachloroethane[4]	5	400	10	400	40	1600
1,1,2,2-Tetrachloroethane	0.65	5.0	1.3	5.0	5.3	20
Tetrachloroethylene[4]	0.25	200	0.5	200	2	800
Toluene	35	1150	70	1150	280	4600
Trichlorobenzenes (total)	3.5	3300	7	3300	28	13200
1,1,1-Trichloroethane[4]	15	1200	30	1200	120	4800
1,1,2-Trichloroethane[4]	0.6	48	1	48	4	192
Trichloroethylene	0.25	11600	2	11600	8	46400
2,4,6-Trichlorophenol	10.0	1770	20	1770	80	7080
Vinyl chloride	0.015	1.5	0.03	1.5	0.12	6.0
Xylenes (total)	25	890	50	890	200	3560
Pesticides[4]						
Aldrin + Dieldrin	0.015	1.2	0.03	1.2	0.03	4.8
DDT + DDD + DDE	1	50	2	50	2	200
2,4-D	1.5	120	3	120	3	480
Chlordane	0.05	4	0.1	4	0.1	16
Heptachlor	0.015	1.2	0.03	1.2	0.03	4.8

Notes *(included for information purposes to support updated SASLP & SASTC values; to be omitted from final Standard)*:

1. SASLP0 values have, where possible, been derived from the *lowest value* of the standard for *human health effect* listed for drinking water in South Africa (DWAF, SANS) by multiplying with a Dilution Attenuation Factor (DAF) of 50 as proposed by the Australian State of Victoria, "Industrial Waste Resource Guidelines: Solid Industrial Waste Hazard Categorisation and Management", June 2009: www.epa..vic.guv.aus. If no standard was available in South Africa then the values given by the WHO or other appropriate drinking water standard, such as those published in the California Regulations have been used.
2. SASTC0 values (=SASTC1), where appropriate, have been derived from the Soil Screening Values for commercial/industrial land determined by the Department of Environmental Affairs contaminated land remediation project ("*Framework for the Management of Contaminated Land",* March 2010. The values of SASTC2 have been derived by multiplying SASTC0 by a factor of 4, as used by the Environmental Protection Agency, Australian State of Victoria. Where South African values for SATC0 were unavailable, in general, the values published by the Environmental Protection Agency, Australian State of Victoria have been used. Some TC values have been adjusted by the team because of various attenuation factors that are observed in landfills: the reasons for an adjustment of a particular value or values are given in the notes below for the specific contaminants.

3. The SASTC0/1/2 values for inorganic As have been selected from the those given by the Environmental Protection Agency, Australian State of Victoria rather than the much lower values that have been derived by the SA contaminated land remediation project. Inorganic arsenic is represented by the element itself, As, arsenic trioxide, arsenic acid, arsenic pentoxide, and the insoluble arsenates that are formed with cations such as Ca and Fe(III). Arsenates/arsenates, in particular, are attenuated in a co-disposal or mono-disposal landfill by the presence of even moderate amounts of Ca^{2+} and $Fe^{2+/3+}$ ions, e.g. in the waste, in cover materials, such as ash and soil, and in the soil below the landfill. The higher values are therefore warranted due to landfill specific factors.
4. No specific Soil Screening Values for these species have been proposed by the SA contaminated land remediation project. However, because of their importance for landfilling in South Africa, the SASTC0/1/2 values used by the Environmental Protection Agency, Australian State of Victoria, have been used.
5. The proposed SA Soil Screening Value for Cr for commercial/industrial land is relatively high, i.e. 800000mg/kg or 80%, which indicates that Cr(III) is considered of little risk to human health and the environment. This figure has been adopted for SASTC0/1 thresholds, but note that materials such as chromium (III) oxide, Cr_2O_3 contain only 68.4% and chromite ore, (Fe, Mg)Cr_2O_4, between 35 and 45% of Cr(III). Thus, provided these compounds leach less than 5mg/l of Cr(III) using the SASLP, they would be considered Very Low Risk (inert) wastes.
6. The proposed SA Soil Screening Value for for Cr(VI) for commercial/industrial land is relatively low, i.e. 40mg/kg, and does not reflect the attenuation of the species that occurs in the landfill environment, where Cr(VI) is reduced to Cr(III) in an anaerobic co-disposal landfill and by Fe(II), Mn(II) and other species both in the anaerobic and mono-disposal situation. The values for SASTC0/1/2 given in the table are those proposed by the Environmental Protection Agency, Australian State of Victoria.
7. SA Soil Screening Values were only proposed as 'investigation levels' for chlorides, fluorides, sulphates, nitrates-nitrites and sulphates, recognising that commonly occurring anions are rarely encountered at concentrations that may impact on human health by direct exposure pathways, but they do however have an important influence on soil quality from an ecological and agricultural perspective. The approach used by the Environmental Protection Agency, Australian State of Victoria has been adopted, i.e. no SASTC0/1/2 values for chloride, sulphate and nitrate are listed. In the landfill situation, where the anion, if mobilised, will be captured in the landfill leachate, it is clearly the leachable concentration that is of key importance and the management of the leachate, i.e. by evaporation, ion exchange, reverse osmosis or other technique, will be expected to recover the anion before it enters the environment. Most simple chloride and nitrate salts are very soluble in water, whereas many sulphate wastes, such as gypsum, $CaSO_4$, and phosphogypsum are relatively insoluble.
8. The proposed SA Soil Screening Value for fluoride, F^-, for commercial/industrial land is relatively low at 30mg/kg and this does not reflect the attenuation that occurs in a landfill situation. Landfills inevitably contain significant amounts of Ca salts and aluminosilicates that attenuate fluoride. Fluoride concentrations in landfill leachates in SA are usually well below the SASLP0 value of 50mg/l. The SASTC0/1/2 values adopted in the table are those used by the Environmental Protection Agency, Australian State of Victoria.
9. The very low SA Soil Screening Value of 1.7mg/l for commercial industrial land is because the species is carcinogenic. Note that this low value is not aligned with the proposed SASLP0 value and chloroform does biodegrade to some extent in the landfill situation. In addition, the Minimum Requirements used a value of 10000mg/l or mg/kg (1%) as the limit to landfill for carcinogens. The values proposed by the Environmental Protection Agency, Australian State of Victoria have therefore been adopted.
10. Methyl t-butyl ether, MTBE, was included in the SA Soil Screening Values as a contaminant of concern, and the SASTC0/1/2 values have been included here. However, no drinking water limit is available in South Africa, so the SASLP0 value was obtained using the human health limit of 50ppb given in the California Regulations, which was multiplied by the DAF of 50 to give an SASLP0 of 2.5mg/l.
11. Total sum of naphthalene, acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluorene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene.

12. The values SASTC0/1/2 for C6 to C9 and C10 to C36 hydrocarbons published by the Environmental Protection Agency, Australian State of Victoria, which are based on the NSW Waste Classification Guidelines, have been adopted rather than the proposed SA Soil Screening Values. The latter gave the following SASTC0 values for C7 to C9, C10 to C14, and, C15 to C36 hydrocarbons of 23000mg/kg, 4400mg/kg and 700000mg/kg (70%), respectively. In the landfill environment the lower hydrocarbons, C6 to C9, in particular, are mobilised due to the fairly high temperatures that can be found during biodegradation, e.g. up to 55^{o}C. In addition, allowing extremely high concentrations of the higher hydrocarbons, C15 to C36 to be disposed at concentrations as high as 700000mg/kg, i.e. 70%, goes against a principle objective of the waste project, i.e. preventing the disposal of organic compounds to landfill and encouraging the recovery and/or utilisation of wastes, such as solvents and petroleum hydrocarbons, for generation of energy.
13. Total sum of phenol, 2-methylphenol (o-cresol), 3-methylphenol (m-cresol), 4-methylphenol (p-cresol), 2,4- dimethylphenol, 2.4-dinitrophenol, 2-methyl-4,6-dinitrophenol, 2-nitrophenol, 4-nitrophenol and 2-cyclohexyl-4,6- dinitrophenol.

4. WASTE RISK PROFILING

(1) Hazardous waste must be assessed against the thresholds specified in Section 3 of this Standard for total concentration (SASTC0, SASTC1 and SASTC2) and leachable concentration (SASLP0, SASLP1 and ASLP2). The assessment must be done for all chemical substances known and reasonably expected to be present in the waste.

(2) Based on the assessment, the Waste Risk Profile must be determined in terms of the following criteria:

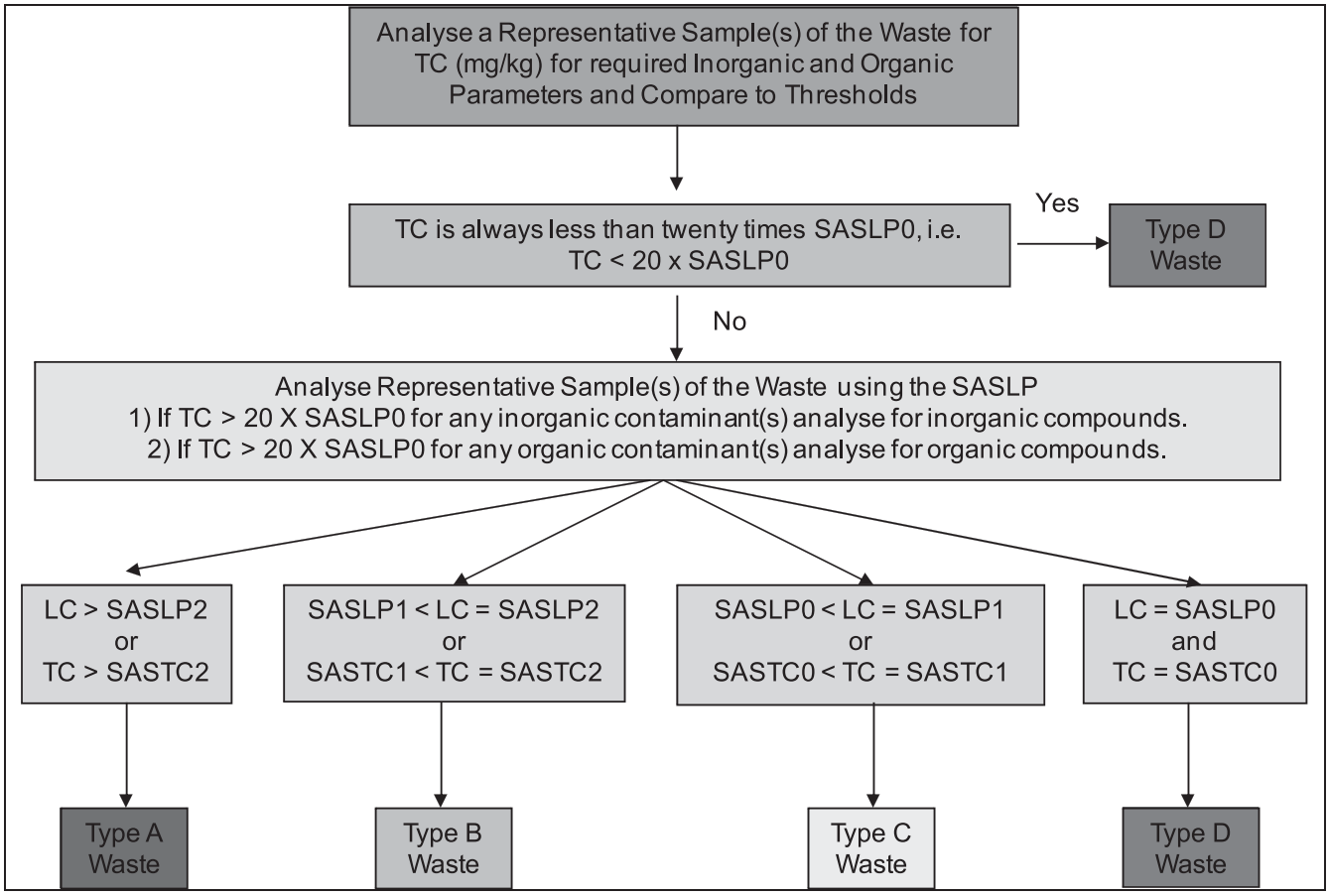
(a) Hazardous wastes with any contaminant level above the SASLP2 or SASTC2 thresholds are wastes considered to pose an extreme risk.

(b) Hazardous wastes with any contaminant level greater than SASLP1 but below SASLP2, or greater than SASTC1 but below SASTC2 are high risk wastes.

(c) Hazardous wastes with any contaminant level greater than SASLP0 but below the SASLP1 and SASTC1 thresholds are moderate risk wastes.

(d) Hazardous wastes with all contaminant levels below both the SASLP0 and SASTC0 thresholds pose a very low risk, and are considered to be essentially inert.

Contaminant Concentration Criteria	Waste Risk Profile	Description
LC > SASLP2, or TC > SASTC2	**A: Extreme Risk**	Considered very high risk waste with a very high potential for contaminant release. Requires very high level of control and ongoing management to protect health and the environment.
SASLP1 < LC ≤ SASLP2, or SASTC1 < TC ≤ SASTC2	**B: High Risk**	Considered high risk waste with high potential for contaminant release. Requires high level of control and ongoing management to protect health and the environment.
SASLP0 < LC ≤ SASLP1, or SASTC0 < TC ≤ SASTC1	**C: Moderate Risk**	Considered low risk waste with some potential for contaminant release. Requires proper control and ongoing management to protect health and the environment.
TC < 20 x SASLP0, or LC ≤ SASLP0 and TC ≤ SASTC0	**D: Very Low Risk**	Very low risk waste with low potential for contaminant release. Requires some level of control and ongoing management to protect health and the environment.



(3) The dilution of a waste by any means to reduce the TC of any contaminant, so that it can meet the SASTC threshold criteria of a particular Waste Risk Profile, is prohibited.

(4) If the TC of a metal or inorganic contaminant(s) is >SASTC2, and the concentration cannot be reduced by waste avoidance or by recycling/recovery, or it is not economically feasible e.g. due to very small quantities, the waste must be stabilised to a minimum of LC < SASLP2 and disposed of as required in terms of the *Standard for Disposal of Waste to Landfill*.

(5) If the TC of an organic contaminant is >SASTC2 and the concentration cannot be reduced by waste avoidance or by recycling/recovery, the waste should be used for an approved process for energy recovery or utilisation, incinerated or otherwise reduced or treated, and any residual inorganic waste disposed to landfill in terms of the *Standard for Disposal of Waste to Landfill*.