ISCOR VANDERBIJLPARK STEEL

ENVIRONMENTAL MASTER PLAN

SPECIALIST REPORT

IDENTIFICATION OF SECONDARY SOURCES OF POLLUTION ENVIRONMENTAL AND HUMAN RISK ASSESSMENT

Volume 3

Evaporation Dams 1 - 4

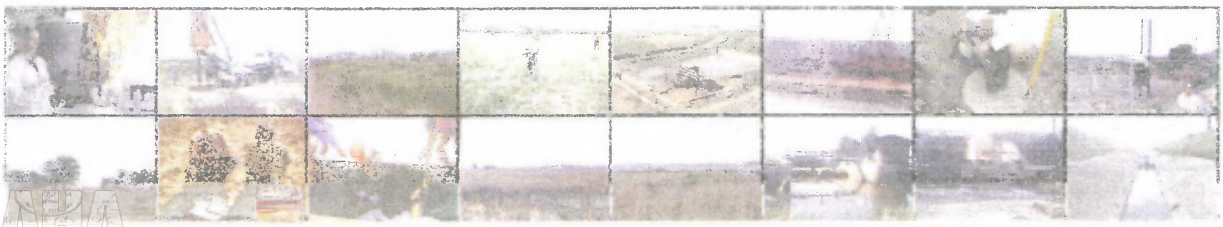
BY

OCKIE FOURIE TOXICOLOGISTS

SERIES IV

DOCUMENT IVS/SR/029(a)

DECEMBER 2002



ISCOR VANDERBIJLPARK STEEL

ENVIRONMENTAL MASTER PLAN

SPECIALIST REPORT

IDENTIFICATION OF SECONDARY SOURCES OF POLLUTION ENVIRONMENTAL AND HUMAN RISK ASSESSMENT

Volume 3

Evaporation Dams 1 - 4

BY

OCKIE FOURIE TOXICOLOGISTS

SERIES IV
DOCUMENT IVS/SR/029(a)
DECEMBER 2002

ISCOR VANDERBIJLPARK STEEL

ENVIRONMENTAL MASTER PLAN
SPECIALIST REPORT

Identification of Secondary Sources of Pollution Environmental and Human Risk Assessment

EVAPORATION DAMS 1 - 4

Volume 3 of 5

SERIES IV
SPECIALIST REPORT IVS / SR / 029(a)

DECEMBER 2002

Compiled by:

OCKIE FOURIE
TOXICOLOGISTS

✉ 73179
LYNNWOOD RIDGE
0040

Menlyn Square, East Block
Cnr Gobie Street & Lois Ave
Newlands, Pretoria 0081
South Africa/ Suid-Afrika
☎ (012) 348-9732/7
Fax: (012) 348-7436
E-Mail: oft@global.co.za
Cell: 082 881 8065

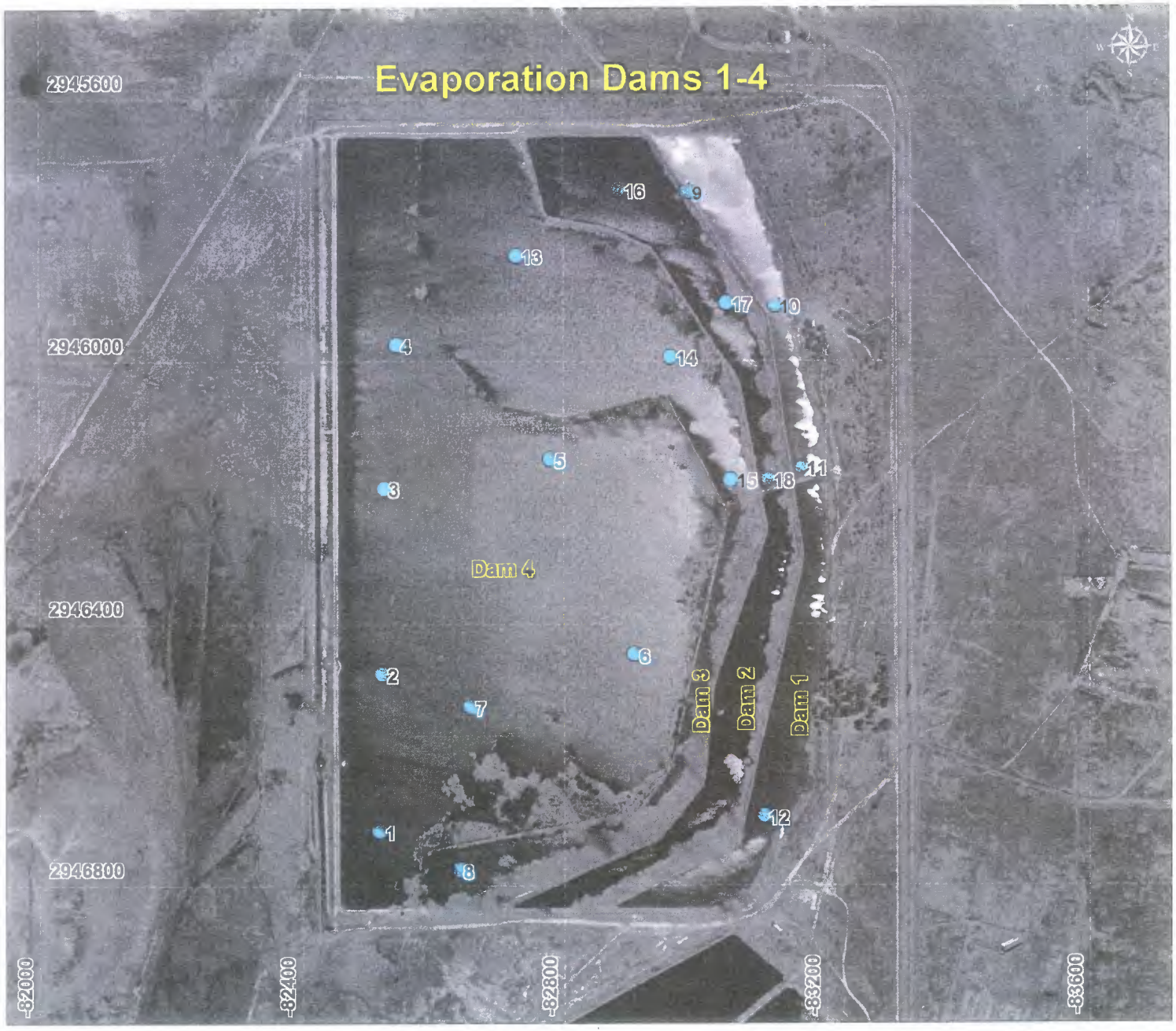
Appendix 2

EVAPORATION DAMS 1 - 4
ENVIRONMENTAL RISK QUANTIFICATION AND HUMAN RISK ASSESSMENT SUMMARY TABLES

EVAPORATION DAM 1

FIGURE 2.1

EVAPORATION DAMS 1 - 4: SAMPLING POSITIONS



LEGEND

Sampling positions

SCALE 1: 6 000

Client: ISCOR Vanderbijlpark Steel
Project: Secondary Resources of Pollution

Ockie Fourie Toxicologists

Date: November 2002

FIGURE 2.1

IVS - Evaporation Dams 1-4: Sampling Positions

TABLES 81 - 84

EVAPORATION DAM 1: WATERS INORGANIC ENVIRONMENTAL RISK QUANTIFICATION

EVAPORATION DAMS 1-4: **Glossary of Abbreviations / Acronyms**

[1] Lab Conc. ppm	Laboratory analysis / concentration in parts per million
[2] EEC ppb	Estimated Environmental Concentration in parts per billion
[3] Risk R/AR (Environment)	R - Potential Unacceptable Risk to Environment AR - Acceptable Risk to Environment
[4] Probit Model	Risk Model Quantification in percentage (%)
[5] Acc Risk Value (MR/SA) ppb	Acceptable Risk Value according Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (DWAF) in parts per billion (Micro's) AND SA Drinking Water Standards recommended Maximum Guideline Value in parts per billion (Macro's)
[6] Acc. Risk Value RfD/ADI/GV mg/kg/day	Reference Dose (RfD) / Acceptable Daily Intake (ADI) / Guideline Value (GV) in milligram/kilogram per day: Environmental Protection Agency (EPA) / World Health Organization(WHO) / Republic of South Africa(RSA)
[7] EPA RfD/EPA DWEL/RSA RfD/WHO GV	Potential Daily Intake for a 60/70 kilogram person
[8] Conc. in Dam water / Lab Conc. ppm	Laboratory analysis / concentration in parts per million
[9] PDI Dam water exposure mg/kg/day	Potential Daily Intake for a 60 kilogram person through oral route (dam water) exposure in milligram/kilogram per day
[10] Margin of Safety %	Potential Daily Intake (PDI) as a percentage of Acceptable Daily Intake (ADI) = Margin of Safety (MOS) / Risk R - Potential Unacceptable Risk to Human AR - Acceptable Risk to Human
[11] Conc. in River water (EEC) ppb	Estimated concentration in river after release of dam water in parts per billion
[12] PDI river water exposure mg/kg/day	Potential Daily Intake for a 60 kilogram person through oral route (river water) exposure in milligram/kilogram per day
[13] Conc. in groundwater (EEC) ppb	Worst Case Scenario from dam water to groundwater in parts per billion
[14] PDI groundwater exposure mg/kg/day	Potential Daily Intake for a 60 kilogram person through oral route (groundwater) exposure in milligram/kilogram per day
NA	Not Analysed

Table 81

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION ♦ DAM WATER ♦ SAMPLE NO. 9 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 9 — EVAPORATION DAM 1: Current Volume = 218,671 kg/ha/m — Total Volume = 483,928 kg/ha/m

RISK TO ENVIRONMENT

INORGANIC COMPOUNDS Micro's and Macro's	[illegible]	RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER							
		TOTAL ANALYSIS			4 PROBIT MODEL		DILUTED WATER		4 PROBIT MODEL		CURRENT VOLUME		4 PROBIT MODEL		TOTAL VOLUME		4 PROBIT MODEL	
		1 Lab Conc. ppm	2 EEC ppb	3 Risk R / AR	Risk Quantification	3 Risk R / AR	2 EEC ppb	3 Risk R / AR	Risk Quantification	3 Risk R / AR	2 EEC ppb	3 Risk R / AR	Risk Quantification	3 Risk R / AR	2 EEC ppb	3 Risk R / AR	Risk Quantification	3 Risk R / AR
Aluminium as Al	[illegible]	0.129	129	AR	0.00E+00	AR	4.3	AR	0.00E+00	AR	18.6	AR	0.00E+00	AR	41.2	AR	0.00E+00	AR
Arsenic as As	430	0.011	11	AR	0.00E+00	AR	0.367	AR	0.00E+00	AR	1.59	AR	0.00E+00	AR	3.51	AR	0.00E+00	AR
Barium as Ba	7000	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cadmium as Cd	31	0.020	20	R*	4.63E-06	R*	0.667	AR	0.00E+00	AR	2.9	AR	0.00E+00	AR	6.39	R*	6.21E-12	R*
Chromium^{3+} as Cr^{3+}	4700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Chromium^{6+} as Cr^{6+}	[illegible]	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cobalt as Co	[illegible]	0.044	44	AR	0.00E+00	AR	1.47	AR	0.00E+00	AR	6.4	AR	0.00E+00	AR	14.1	AR	0.00E+00	AR
Copper as Cu	100	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cyanide as CN	5	0.22	220	R	9.97E+01	R	7.33	R	5.56E-03	R	31.8	R	1.59E+01	R	70.3	R	7.10E+01	R
Iron as Fe	9000	0.118	118	AR	0.00E+00	AR	3.93	AR	0.00E+00	AR	17	AR	0.00E+00	AR	37.7	AR	0.00E+00	AR
Lead as Pb	100	0.083	83	AR	5.95E-05	AR	2.77	AR	0.00E+00	AR	12	AR	0.00E+00	AR	26.5	AR	1.50E-10	AR
Manganese as Mn	300	0.038	38	AR	1.11E-14	AR	1.27	AR	0.00E+00	AR	5.5	AR	0.00E+00	AR	12.1	AR	0.00E+00	AR
Mercury as Hg	22	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Nickel as Ni	1140	0.066	66	AR	0.00E+00	AR	2.20	AR	0.00E+00	AR	9.5	AR	0.00E+00	AR	21.1	AR	0.00E+00	AR
Selenium as Se	260	0.005	5	AR	0.00E+00	AR	0.167	AR	0.00E+00	AR	0.722	AR	0.00E+00	AR	1.60	AR	0.00E+00	AR
Titanium as Ti	731	0.15	150	AR	5.85E-12	AR	5.0	AR	0.00E+00	AR	21.6	AR	0.00E+00	AR	47.9	AR	0.00E+00	AR
Vanadium as V	1300	0.11	110	AR	0.00E+00	AR	3.67	AR	0.00E+00	AR	15.9	AR	0.00E+00	AR	35.1	AR	0.00E+00	AR
Zinc as Zn	700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Calcium as Ca	150000	5	5000	AR	0.00E+00	AR	167	AR	0.00E+00	AR	722	AR	0.00E+00	AR	1597	AR	0.00E+00	AR
Chloride as Cl	250000	1092	1092000	R	5.28E+00	R	36400	AR	6.66E-14	AR	157601	AR	3.63E-06	AR	348777	R	5.94E-03	R
Fluoride as F	1500	6.8	6800	R	6.10E+00	R	227	AR	1.11E-13	AR	981	AR	5.35E-06	AR	2172	R	7.96E-03	R
Magnesium as Mg	70000	2	2000	AR	0.00E+00	AR	67	AR	0.00E+00	AR	289	AR	0.00E+00	AR	639	AR	0.00E+00	AR
Potassium as K	200000	266	266000	R	4.04E-03	R	8867	AR	0.00E+00	AR	38390	AR	2.49E-12	AR	84958	AR	4.50E-08	AR
Sodium as Na	100000	1807	1807000	R	8.76E+01	R	60233	AR	2.24E-06	AR	260791	R	4.31E-01	R	577142	R	1.41E+01	R
Sulphate as SO_4	200000	2833	2833000	R	7.52E+01	R	94433	AR	1.52E-07	AR	408867	R	9.59E-02	R	904839	R	6.06E+00	R
Boron as B	17000	2.0	2000	AR	0.00E+00	AR	66.7	AR	0.00E+00	AR	289	AR	0.00E+00	AR	639	AR	0.00E+00	AR
Nitrate as N	9000	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				R		R		R		R		R		R		R		R

Table 82

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 10 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 10

INORGANIC COMPOUNDS Micro's and Macro's	Risk Value (MR&SA) ppb	RISK TO ENVIRONMENT														
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER					
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME	[4] PROBIT MODEL
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR
Aluminium as Al	10000	0.119	119	AR	0.00E+00	AR	3.97	AR	0.00E+00	AR	17.2	AR	0.00E+00	AR	38.0	AR	0.00E+00	AR
Arsenic as As	430	0.006	6.0	AR	0.00E+00	AR	0.20	AR	0.00E+00	AR	0.866	AR	0.00E+00	AR	1.92	AR	0.00E+00	AR
Barium as Ba	7800	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cadmium as Cd	31	0.018	18	R*	1.51E-06	R*	0.60	AR	0.00E+00	AR	2.6	AR	0.00E+00	AR	5.75	R*	1.60E-12	R*
Chromium^{3+} as Cr^{3+}	4700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Chromium^{6+} as Cr^{6+}	20	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cobalt as Co	6900	0.03	30	AR	0.00E+00	AR	1.0	AR	0.00E+00	AR	4.33	AR	0.00E+00	AR	9.6	AR	0.00E+00	AR
Copper as Cu	100	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cyanide as CN	5.3	0.06	60	R	5.86E+01	R	2.0	AR	1.12E-08	AR	8.7	R	2.00E-02	R	19.2	R	2.36E+00	R
Iron as Fe	9000	0.042	42	AR	0.00E+00	AR	1.4	AR	0.00E+00	AR	6.1	AR	0.00E+00	AR	13.4	AR	0.00E+00	AR
Lead as Pb	100	0.070	70	AR	1.08E-05	AR	2.33	AR	0.00E+00	AR	10.1	AR	0.00E+00	AR	22.4	AR	1.79E-11	AR
Manganese as Mn	300	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Mercury as Hg	22	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Nickel as Ni	1140	0.059	59	AR	0.00E+00	AR	1.97	AR	0.00E+00	AR	8.5	AR	0.00E+00	AR	18.8	AR	0.00E+00	AR
Selenium as Se	260	< 0.005	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Titanium as Ti	731	< 0.03	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Vanadium as V	1300	0.09	90	AR	0.00E+00	AR	3.0	AR	0.00E+00	AR	13.0	AR	0.00E+00	AR	28.7	AR	0.00E+00	AR
Zinc as Zn	700	0.026	26	AR	0.00E+00	AR	0.867	AR	0.00E+00	AR	3.8	AR	0.00E+00	AR	8.30	AR	0.00E+00	AR
Calcium as Ca	150000	20	20000	AR	2.22E-14	AR	667	AR	0.00E+00	AR	2886	AR	0.00E+00	AR	6388	AR	0.00E+00	AR
Chloride as Cl	250000	1092	1092000	R	5.28E+00	R	36400	AR	6.66E-14	AR	157601	AR	3.63E-06	AR	348777	R	5.94E-03	R
Fluoride as F	1500	5.5	5500	R	2.50E+00	R	183	AR	1.11E-14	AR	794	AR	5.47E-07	AR	1757	R	1.40E-03	R
Magnesium as Mg	70000	10	10000	AR	5.55E-14	AR	333	AR	0.00E+00	AR	1443	AR	0.00E+00	AR	3194	AR	0.00E+00	AR
Potassium as K	200000	237	237000	R	1.54E-03	R	7900	AR	0.00E+00	AR	34205	AR	5.55E-13	AR	75696	AR	1.16E-08	AR
Sodium as Na	100000	1574	1574000	R	8.12E+01	R	52467	AR	4.96E-07	AR	227164	R	1.89E-01	R	502724	R	8.95E+00	R
Sulphate as SO_4	200000	2722	2722000	R	7.27E+01	R	90733	AR	9.61E-08	AR	392847	R	7.35E-02	R	869386	R	5.17E+00	R
Boron as B	17000	1.5	1500	AR	0.00E+00	AR	50	AR	0.00E+00	AR	216	AR	0.00E+00	AR	479	AR	0.00E+00	AR
Nitrate as N	9000	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R				R		AR		AR		R		R		R		R

Table 83

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 11 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 11

INORGANIC COMPOUNDS Micro's and Macro's	Acc. Risk Value (MR&SA) ppb	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER						
		TOTAL ANALYSIS			[4]PROBIT MODEL		DILUTED WATER		[4]PROBIT MODEL		CURRENT VOLUME		[4]PROBIT MODEL		TOTAL VOLUME		[4]PROBIT MOOEL
		[1]Lab Conc. ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification	[3]Risk R / AR
Aluminium as Al		0.110	110		0.00E+00		3.67		0.00E+00		15.9		0.00E+00		35.1		0.00E+00	
Arsenic as As		0.005	5.0		0.00E+00		0.167		0.00E+00		0.722		0.00E+00		1.60		0.00E+00	
Barium as Ba		< 0.10	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Cadmium as Cd	31	0.021	21	R*	7.72E-06	R*	0.70		0.00E+00		3.0		0.00E+00		6.71	R*	1.16E-11	R*
Chromium^{3+} as Cr^{3+}		< 0.025	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Chromium^{6+} as Cr^{6+}	20	< 0.025	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Cobalt as Co		0.035	35		0.00E+00		1.2		0.00E+00		5.1		0.00E+00		11.2		0.00E+00	
Copper as Cu		< 0.025	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Cyanide as CN		< 0.05	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Iron as Fe		0.187	187		0.00E+00		6.2		0.00E+00		27.0		0.00E+00		59.7		0.00E+00	
Lead as Pb		0.078	78		3.23E-05		2.6		0.00E+00		11.3		0.00E+00		24.9		6.84E-11	
Manganese as Mn		0.175	175		1.58E-06		5.8		0.00E+00		25.3		0.00E+00		55.9		1.70E-12	
Mercury as Hg	22	< 0.002	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Nickel as Ni		0.059	59		0.00E+00		1.97		0.00E+00		8.52		0.00E+00		18.8		0.00E+00	
Selenium as Se		< 0.005	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
Titanium as Ti		0.10	100		3.33E-14		3.3		0.00E+00		14.4		0.00E+00		31.9		0.00E+00	
Vanadium as V		0.05	50		0.00E+00		1.7		0.00E+00		7.22		0.00E+00		16.0		0.00E+00	
Zinc as Zn		0.044	44		0.00E+00		1.47		0.00E+00		6.35		0.00E+00		14.1		0.00E+00	
Calcium as Ca		84	84000		1.02E-06		2800		0.00E+00		12123		0.00E+00		26829		9.99E-13	
Chloride as Cl		1141	1141000	R	6.26E+00	R	38033		1.22E-13		164672		5.76E-06		364427	R	8.39E-03	R
Fluoride as F		6.0	6000	R	3.67E+00	R	200		2.22E-14		866		1.42E-06		1916	R	2.90E-03	R
Magnesium as Mg		21	21000		6.97E-10		700		0.00E+00		3031		0.00E+00		6707		0.00E+00	
Potassium as K	200000	225	225000	R	9.87E-04	R	7500		0.00E+00		32473		2.89E-13		71863		6.24E-09	
Sodium as Na	100000	1534	1534000	R	7.99E+01	R	51133		3.72E-07		221391	R	1.61E-01	R	489948	R	8.16E+00	R
Sulphate as SO_4	200000	2722	2722000	R	7.27E+01	R	90733		9.61E-08		392847	R	7.35E-02	R	869386	R	5.17E+00	R
Boron as B		1.7	1700		0.00E+00		57		0.00E+00		245		0.00E+00		543		0.00E+00	
Nitrate as N		< 0.2	0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00		0.00		0.00E+00	
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R				R		R		R		R		R		

Table 84

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 12 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 12

COMPOUNDS Micro's and Macro's	[illegible] Value	RISK TO ENVIRONMENT																
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER							
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL	
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR
Aluminium as Al	[illegible]	0.101	101	AR	0.00E+00	AR	3.37	AR	0.00E+00	AR	14.6	AR	0.00E+00	AR	32.3	AR	0.00E+00	AR
Arsenic as As	[illegible]	< 0.05	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Barium as Ba	[illegible]	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cadmium as Cd	[illegible]	0.022	22	R*	1.25E-05	R*	0.733	AR	0.00E+00	AR	3.18	R*	0.00E+00	R*	7.03	R*	2.10E-11	R*
Chromium^{3+} as Cr^{3+}	[illegible]	0.025	25	AR	0.00E+00	AR	0.833	AR	0.00E+00	AR	3.61	AR	0.00E+00	AR	7.98	AR	0.00E+00	AR
Chromium^{6+} as Cr^{6+}	[illegible]	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cobalt as Co	[illegible]	0.036	36	AR	0.00E+00	AR	1.2	AR	0.00E+00	AR	5.2	AR	0.00E+00	AR	11.5	AR	0.00E+00	AR
Copper as Cu	[illegible]	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Cyanide as CN	[illegible]	< 0.05	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Iron as Fe	[illegible]	0.356	356	AR	0.00E+00	AR	11.9	AR	0.00E+00	AR	51.4	AR	0.00E+00	AR	113.7	AR	0.00E+00	AR
Lead as Pb	[illegible]	0.083	83	AR	5.95E-05	AR	2.8	AR	0.00E+00	AR	12.0	AR	0.00E+00	AR	26.5	AR	1.50E-10	AR
Manganese as Mn	[illegible]	0.275	275	AR	1.54E-04	AR	9.2	AR	0.00E+00	AR	39.7	AR	2.22E-14	AR	87.8	AR	5.13E-10	AR
Mercury as Hg	[illegible]	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Nickel as Ni	[illegible]	0.062	62	AR	0.00E+00	AR	2.07	AR	0.00E+00	AR	8.95	AR	0.00E+00	AR	19.8	AR	0.00E+00	AR
Selenium as Se	[illegible]	< 0.005	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
Titanium as Ti	[illegible]	0.16	160	AR	1.34E-11	AR	5.3	AR	0.00E+00	AR	23.1	AR	0.00E+00	AR	51.1	AR	0.00E+00	AR
Vanadium as V	[illegible]	0.04	40	AR	0.00E+00	AR	1.3	AR	0.00E+00	AR	5.8	AR	0.00E+00	AR	12.8	AR	0.00E+00	AR
Zinc as Zn	[illegible]	0.065	65	AR	0.00E+00	AR	2.17	AR	0.00E+00	AR	9.4	AR	0.00E+00	AR	20.8	AR	0.00E+00	AR
Calcium as Ca	[illegible]	112	112000	AR	2.09E-05	AR	3733	AR	0.00E+00	AR	16164	AR	0.00E+00	AR	35772	AR	3.97E-11	AR
Chloride as Cl	250000	1166	1166000	R	6.80E+00	R	38867	AR	1.67E-13	AR	168280	AR	7.22E-06	AR	372412	R	9.93E-03	R
Fluoride as F	1500	6.4	6400	R	4.80E+00	R	213	AR	5.55E-14	AR	924	AR	2.84E-06	AR	2044	R	4.92E-03	R
Magnesium as Mg	70000	26	26000	AR	9.27E-09	AR	867	AR	0.00E+00	AR	3752	AR	0.00E+00	AR	8304	AR	0.00E+00	AR
Potassium as K	200000	222	222000	R	8.77E-04	R	7400	AR	0.00E+00	AR	32040	AR	2.44E-13	AR	70905	AR	5.31E-09	AR
Sodium as Na	100000	1521	1521000	R	7.94E+01	R	50700	AR	3.38E-07	AR	219515	R	1.52E-01	R	485796	R	7.91E+00	R
Sulphate as SO_4	200000	2256	2256000	R	5.93E+01	R	75200	AR	1.07E-08	AR	325592	R	1.95E-02	R	720549	R	2.30E+00	R
Boron as B	[illegible]	1.6	1600	AR	0.00E+00	AR	53	AR	0.00E+00	AR	231	AR	0.00E+00	AR	511	AR	0.00E+00	AR
Nitrate as N	[illegible]	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R		R		AR		R		R		R		R		R

TABLES 85 – 88

EVAPORATION DAM 1: WATERS INORGANIC

HUMAN RISK ASSESSMENT

Table 85

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 9 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 9

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI / GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.129	0.0043	86	4.30	0.0001	1.9	18.6	0.0006	12.4
Arsenic as As	0.0003	EPA RfD	0.011	0.0004	122	0.367	0.00001	4.06	1.59	0.00005	17.7
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.020	0.0007	133	0.667	0.00002	4.45	2.89	0.00010	19.3
Chromium $^{3+}$ as Cr^{3+}	1.50	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium $^{6+}$ as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.044	0.0015	18.3	1.47	0.00005	0.613	6.35	0.00021	2.65
Copper as Cu	0.04	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyanide as CN	0.04	EPA RfD	0.22	0.0073	18	7.33	0.00024	0.611	31.8	0.0011	2.65
Iron as Fe	0.003	RSA RfD	0.118	0.0039	131	3.9	0.00013	4.33	17	0.0006	19.3
Lead as Pb	0.002	RSA RfD	0.083	0.0028	138	2.8	0.00009	4.62	12.0	0.0004	20.0
Manganese as Mn	0.046	EPA RfD	0.038	0.0013	2.8	1.3	0.00004	0.087	5.5	0.0002	0.362
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.066	0.0022	11.0	2.20	0.00007	0.367	9.5	0.00032	1.59
Selenium as Se	0.005	EPA RfD	0.005	0.0002	4.0	0.167	0.000006	0.113	0.722	0.00002	0.481
Titanium as Ti	0.003	RSA RfD	0.15	0.005	167	5.0	0.00017	5.7	21.6	0.0007	24
Vanadium as V	0.009	EPA RfD	0.11	0.004	41	3.67	0.00012	1.36	15.9	0.001	5.89
Zinc as Zn	0.3	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	5	0.167	3.33	167	0.0056	0.11	722	0.024	0.481
Chloride as Cl	8.3	RSA RfD	1092	36.4	439	36400	1.21	14.6	157601	5.25	63.3
Fluoride as F	0.06	EPA RfD	6.8	0.227	378	227	0.0076	12.6	981	0.033	54.5
Magnesium as Mg	2.3	RSA RfD	2	0.067	2.90	67	0.0022	0.097	289	0.010	0.419
Potassium as K	6.7	RSA RfD	266	8.87	132	8867	0.296	4.4	38390	1.28	19.1
Sodium as Na	3.3	RSA RfD	1807	60.2	1825	60233	2.0	61	260791	8.7	263
Sulphate as SO_4	6.7	RSA RfD	2833	94.4	1409	94433	3.15	47	408867	13.6	203
Boron as B	0.09	EPA RfD	2.0	0.067	74.1	67	0.0022	2.43	289	0.010	10.7
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	R		River water	AA		Groundwater	R

Table 86

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 10 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 10

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI / GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.119	0.0040	79.9	3.97	0.00013	2.64	17.2	0.0006	11.5
Arsenic as As	0.0003	EPA RfD	0.006	0.0002	66.7	0.200	0.000007	2.22	0.866	0.00003	9.6
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.018	0.0006	120	0.600	0.00002	4.0	2.60	0.00009	17.3
Chromium^{3+} as Cr^{3+}	1.50	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.03	0.0010	12.5	1.00	0.00003	0.417	4.33	0.00014	1.80
Copper as Cu	0.04	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyanide as CN	0.04	EPA RfD	0.06	0.0020	5.0	2.00	0.00007	0.167	8.66	0.0003	0.723
Iron as Fe	0.003	RSA RfD	0.042	0.0014	46.7	1.4	0.00005	1.56	6.06	0.0002	6.73
Lead as Pb	0.002	RSA RfD	0.07	0.002	117	2.3	0.0001	3.85	10.1	0.0003	16.8
Manganese as Mn	0.046	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.059	0.0020	9.83	1.97	0.00007	0.328	8.52	0.0003	1.42
Selenium as Se	0.005	EPA RfD	< 0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	< 0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	0.09	0.0030	33.3	3.00	0.0001	1.11	13.0	0.0004	4.81
Zinc as Zn	0.3	EPA RfD	0.026	0.0009	0.289	0.867	0.00003	0.010	3.8	0.0001	0.042
Calcium as Ca	5.0	RSA RfD	20	0.667	13.3	667	0.022	0.445	2886	0.096	1.92
Chloride as Cl	8.3	RSA RfD	1092	36	439	36400	1.21	14.6	157601	5.25	63.3
Fluoride as F	0.06	EPA RfD	5.5	0.183	306	183	0.006	10.1	794	0.026	44.1
Magnesium as Mg	2.4	RSA RfD	10	0.333	13.9	333	0.011	0.463	1443	0.048	2.00
Potassium as K	6.7	RSA RfD	237	7.9	118	7900	0.263	3.93	34205	1.14	17.0
Sodium as Na	3.3	RSA RfD	1574	52	1580	52467	1.75	53	227164	7.6	229
Sulphate as SO_4	6.7	RSA RfD	2722	91	1354	90733	3.02	45.1	392847	13.1	195
Boron as B	0.09	EPA RfD	1.5	0.050	55.6	50	0.0017	1.85	216	0.0072	8.0
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	R		River water	AR		Groundwater	R

Table 87

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 11 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 11

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI / GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.11	0.0037	73.3	3.67	0.00012	2.45	15.9	0.00053	10.6
Arsenic as As	0.0003	EPA RfD	0.005	0.0002	55.6	0.167	0.00001	1.86	0.722	0.00002	8.0
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.021	0.0007	140	0.700	0.00002	4.7	3.03	0.0001	20.3
Chromium^{3+} as Cr^{3+}	1.50	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.035	0.0012	14.6	1.20	0.00004	0.500	5.05	0.00017	2.10
Copper as Cu	0.04	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyanide as CN	0.04	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	0.187	0.006	208	6.2	0.0002	6.9	27	0.0009	30
Lead as Pb	0.002	RSA RfD	0.073	0.003	130	2.6	0.0001	4.3	11.3	0.0004	18.8
Manganese as Mn	0.046	EPA RfD	0.175	0.006	12.7	5.8	0.0002	0.420	25.3	0.0008	1.83
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.059	0.0020	9.8	1.97	0.00007	0.328	8.5	0.0003	1.42
Selenium as Se	0.005	EPA RfD	< 0.005	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	0.10	0.003	111	3.3	0.00011	3.67	14.4	0.0005	16
Vanadium as V	0.009	EPA RfD	0.05	0.0017	18.9	1.70	0.0001	0.63	7.22	0.0002	2.67
Zinc as Zn	0.3	EPA RfD	0.044	0.0015	0.489	1.47	0.00005	0.016	6.35	0.0002	0.071
Calcium as Ca	5.0	RSA RfD	84	2.8	56	2800	0.093	1.87	12123	0.404	8.1
Chloride as Cl	8.3	RSA RfD	1141	38	458	38033	1.27	15.3	164672	5.49	66.1
Fluoride as F	0.06	EPA RfD	6.0	0.200	333	200	0.0067	11.1	866	0.029	48.1
Magnesium as Mg	2.3	RSA RfD	21	0.70	30	700	0.023	1.01	3031	0.101	4.4
Potassium as K	6.7	RSA RfD	225	7.5	112	7500	0.250	3.73	32473	1.08	16.2
Sodium as Na	3.3	RSA RfD	1533	51	1549	51133	1.70	51.6	221391	7.38	224
Sulphate as SO_4	6.7	RSA RfD	2722	91	1354	90733	3.02	46.1	392847	13.09	195
Boron as B	0.09	EPA RfD	1.7	0.057	63.0	57	0.0019	2.11	245	0.008	9.1
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	R		River water	AR		Groundwater	R

Table 88

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 12 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 12

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI / GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.101	0.0034	67.3	3.37	0.00011	2.25	14.6	0.00049	9.75
Arsenic as As	0.0003	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.022	0.0007	147	0.733	0.00002	4.90	3.18	0.00011	21.2
Chromium^{3+} as Cr^{3+}	1.50	EPA RfD	0.025	0.0008	0.056	0.833	0.00003	0.0019	3.61	0.0001	0.006
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.036	0.0012	15.3	1.20	0.00004	0.500	5.20	0.00017	2.17
Copper as Cu	0.04	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyanide as CN	0.04	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	0.356	0.012	396	11.9	0.0004	13.2	51	0.0017	57.1
Lead as Pb	0.002	RSA RfD	0.083	0.003	138	2.8	0.0001	4.67	12.0	0.0004	20
Manganese as Mn	0.046	EPA RfD	0.275	0.009	19.5	9.2	0.0003	0.667	40	0.0013	2.90
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.062	0.0021	10.3	2.07	0.00007	0.345	9.0	0.0003	1.49
Selenium as Se	0.005	EPA RfD	< 0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	0.16	0.005	178	5.3	0.00018	5.99	23	0.001	35.7
Vanadium as V	0.009	EPA RfD	0.04	0.001	11	1.30	0.00004	0.481	5.80	0.0002	2.15
Zinc as Zn	0.3	EPA RfD	0.065	0.002	0.722	2.17	0.00007	0.024	9.4	0.0003	0.104
Calcium as Ca	5.0	RSA RfD	112	3.7	75	3733	0.124	2.49	16164	0.539	10.8
Chloride as Cl	8.3	RSA RfD	1166	39	468	38867	1.30	15.6	168280	5.61	67.6
Fluoride as F	0.06	EPA RfD	6.4	0.213	356	213	0.007	11.8	924	0.031	51.3
Magnesium as Mg	2.3	RSA RfD	26	0.867	38	867	0.029	1.26	3752	0.125	5.4
Potassium as K	6.7	RSA RfD	222	7.4	110	7400	0.247	3.7	32040	1.07	15.9
Sodium as Na	3.3	RSA RfD	1521	51	1536	50700	1.69	51.2	219515	7.3	222
Sulphate as SO_4	6.7	RSA RfD	2250	75	1122	75200	2.51	37.4	325592	10.9	162
Boron as B	0.09	EPA RfD	1.6	0.053	59.2	53	0.0018	1.96	231	0.008	8.6
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	R		River water	AR		Groundwater	R

Table 89

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO's 9D & 10D [ORGANICS - PAH's & VOC's]
[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 9D

ORGANIC COMPOUNDS PAH's & VOC's	[illegible] Value (DWAF) ppb	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER						
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR
Butylbenzylphthalate	530	0.000	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR
Phenol	2690	0.087	87	AR	0E+00	AR	2.90	AR	0E+00	AR	12.6	AR	0E+00	AR	27.8	AR	0E+00	AR
2-Methylphenol	1460	0.024	24	AR	0E+00	AR	0.80	AR	0E+00	AR	3.5	AR	0E+00	AR	7.7	AR	0E+00	AR
4-Methylphenol	1470	0.110	110	AR	0E+00	AR	3.67	AR	0E+00	AR	15.9	AR	0E+00	AR	35.1	AR	0E+00	AR
2,4-Dimethylphenol	1270	0.041	41	AR	0E+00	AR	1.37	AR	0E+00	AR	5.9	AR	0E+00	AR	13.1	AR	0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				AR		AR		AR		AR		AR		AR		AR		AR

SAMPLE NUMBER: 10D

Butylbenzylphthalate	530	0.000	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.003	3.0	AR	0E+00	AR	0.10	AR	0E+00	AR	0.43	AR	0E+00	AR	0.96	AR	0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR	0.00	AR	0E+00	AR
Phenol	2690	0.052	52	AR	0E+00	AR	1.73	AR	0E+00	AR	7.50	AR	0E+00	AR	16.6	AR	0E+00	AR
2-Methylphenol	1460	0.019	19	AR	0E+00	AR	0.63	AR	0E+00	AR	2.74	AR	0E+00	AR	6.1	AR	0E+00	AR
4-Methylphenol	1470	0.068	68	AR	0E+00	AR	2.27	AR	0E+00	AR	9.81	AR	0E+00	AR	21.7	AR	0E+00	AR
2,4-Dimethylphenol	1270	0.024	24	AR	0E+00	AR	0.80	AR	0E+00	AR	3.46	AR	0E+00	AR	7.67	AR	0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				AR		AR		AR		AR		AR		AR		AR		AR

Table 90

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO's 11D & 12D [ORGANICS - PAH's & VOC's]
[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 11D

ORGANIC COMPOUNDS PAH's & VOC's	[5] RLL Value (WRI) ppb	RISK TO ENVIRONMENT																
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER							
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL	
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification	[3] Risk R / AR
Butylbenzylphthalate	5000	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Phenol	2690	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2-Methylphenol	1460	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
4-Methylphenol	1470	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2,4-Dimethylphenol	1270	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		AR		AR			AR		AR			AR		AR		AR		AR

SAMPLE NUMBER: 12D

Butylbenzylphthalate	5000	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Phenol	2690	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2-Methylphenol	1460	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
4-Methylphenol	1470	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2,4-Dimethylphenol	1270	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		AR		AR			AR		AR			AR		AR		AR		AR

TABLES 91 - 92

EVAPORATION DAM 1: WATERS ORGANIC
HUMAN RISK ASSESSMENT

TABLES 93 - 94

EVAPORATION DAM 1: SEDIMENTS INORGANIC

ENVIRONMENTAL RISK QUANTIFICATION

Table 91

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO's 9D & 10D - [ORGANICS - PAH's & VOC's]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 9D

ORGANIC COMPOUNDS PAH[5] & VOC[5]	[6] RfD/ ADI / GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.0
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.0
Phenol	0.6	EPA RfD	0.087	0.0029	0.483	2.90	0.00010	0.02	12.6	0.00042	0.07
2-Methylphenol	0.05	EPA RfD	0.024	0.0008	1.6	0.80	0.00003	0.05	3.5	0.00012	0.233
4-Methylphenol	0.005	EPA RfD	0.110	0.0037	73	3.67	0.00012	2.4	15.9	0.00053	10.
2,4-Dimethylphenol	0.02	EPA RfD	0.041	0.0014	6.	1.37	0.00005	0.23	5.9	0.00020	1.0
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	AR		River water	AR		Groundwater	AR

SAMPLE NUMBER: 10D

Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.003	0.0001	0.5	0.10	0.000003	0.02	0.43	0.000014	0.07
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.052	0.0017	0.289	1.73	0.00006	0.01	7.5	0.00025	0.042
2-Methylphenol	0.05	EPA RfD	0.019	0.0006	1.3	0.63	0.00002	0.04	2.74	0.00009	0.183
4-Methylphenol	0.005	EPA RfD	0.068	0.0023	45	2.27	0.00008	1.5	9.81	0.00033	6.54
2,4-Dimethylphenol	0.02	EPA RfD	0.024	0.0008	4.0	0.80	0.00003	0.13	3.46	0.00012	0.577
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	AR		River water	AR		Groundwater	AR

Table 92

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO's 11D & 12D - [ORGANICS - PAH's & VOC's]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 11D

ORGANIC COMPOUNDS PAH's & VOC's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-Dimethylphenol	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	AR		River water	AR		Groundwater	AR

SAMPLE NUMBER: 12D

Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-Dimethylphenol	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	AR		River water	AR		Groundwater	AR

Table 93

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION ♦ SEDIMENTS ♦ SAMPLE NO's: 9&10 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NO.: 9&10		RISK TO ENVIRONMENT																			
		RISK OF SEDIMENTS FOR GROUNDWATER																			
		SAMPLE NO. 9 [Volume = 1,250,000 kg/ha/m]										SAMPLE NO. 10 [Volume = 1,250,000 kg/ha/m]									
INORGANIC COMPOUNDS		TOTAL ANALYSIS			PROBIT MODEL [4]		TCLP EXTRACTION			PROBIT MODEL [4]		TOTAL ANALYSIS			PROBIT MODEL [4]		TCLP EXTRACTION			PROBIT MODEL [4]	
Micro's and Macro's	[3] Acc. Risk Value [illegible] ppb	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR
Aluminium as Al	10000	4700	3877500	R	1.00E+02	R	0.83	685	AR	0.00E+00	AR	15000	12375000	R	1.00E+02	R	0.11	91	AR	0.00E+00	AR
Arsenic as As	450	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR
Barium as Ba	7000	12	9900	R	2.75E-03	R	0.51	421	AR	0.00E+00	AR	19	15675	R	8.56E-02	R	0.47	388	AR	0.00E+00	AR
Cadmium as Cd	31	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR
Chromium^{3+} as Cr^{3+}	4700	61	50325	R	5.53E+01	R	< 0.04	0.00	AR	0.00E+00	AR	62	51150	R	5.66E+01	R	< 0.04	0.00	AR	0.00E+00	AR
Cobalt as Co	3300	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR	10	8250	R	1.67E-03	R	< 0.12	0.00	AR	0.00E+00	AR
Copper as Cu	1000	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR
Iron as Fe	9000	4000	3300000	R	1.00E+02	R	16	13200	R	8.80E-03	R	8100	6682500	R	1.00E+02	R	90	74250	R	3.54E+01	R
Lead as Pb	100	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR
Manganese as Mn	300	300	247500	R	1.00E+02	R	11	9075	R	9.85E+01	R	150	123750	R	1.00E+02	R	11	9075	R	9.85E+01	R
Mercury as Hg	22	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Nickel as Ni	1340	12	9900	R	3.91E+01	R	< 0.05	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR
Selenium as Se	300	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+0[illegible]	AR	< 0.05	0.00	AR	0.00E+00	AR
Titanium as Ti	731	220	181500	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR	100	82500	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR
Vanadium as V	1330	21	17325	R	7.13E+01	R	< 0.07	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.07	0.00	AR	0.00E+00	AR
Zinc as Zn	7000	37	30525	R	9.98E+01	R	< 0.17	0.00	AR	0.00E+00	AR	32	26400	R	9.95E+01	R	< 0.17	0.00	AR	0.00E+00	AR
Calcium as Ca	150000	330	272250	R	4.27E-02	R	1900	1567500	R	5.34E+01	R	75	61875	AR	3.20E-08	AR	620	511500	R	1.78E+00	R
Chloride as Cl	250000	200	165000	AR	5.88E-06	AR	50	41250	AR	3.55E-13	AR	300	247500	AR	3.15E-04	AR	10	8250	AR	0.00E+00	AR
Fluoride as F	14000	1.04	858	AR	1.28E-06	AR	1.2	990	AR	5.88E-06	AR	1.5	1238	AR	5.64E-05	AR	3	2475	R	2.15E-02	R
Magnesium as Mg	70000	5100	4207500	R	1.00E+02	R	140	115500	R	2.15E-02	R	1100	907500	R	6.94E+01	R	19	15675	AR	1.79E-11	AR
Potassium as K	200000	1300	1072500	R	1.12E+01	R	48	39600	AR	3.71E-12	AR	1600	1320000	R	2.08E+01	R	37	30525	AR	1.22E-13	AR
Sodium as Na	100000	3000	2475000	R	9.62E+01	R	NA	0.00	AR	0.00E+00	AR	2000	1650000	R	8.36E+01	R	NA	0.00	AR	0.00E+00	AR
Sulphate as SO_4	200000	250	206250	R	4.56E-04	R	< 1.0	0.00	AR	0.00E+00	AR	300	247500	R	2.23E-03	R	< 1.0	0.00	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				R		R			R		R			R		R			R		R

Table 94

EVAPORATION DAM 1: ENVIRONMENTAL RISK QUANTIFICATION ♦ SEDIMENTS ♦ SAMPLE NO's: 11&12 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NO.: 11&12	RISK TO ENVIRONMENT																				
		RISK OF SEDIMENTS FOR GROUNDWATER																			
		SAMPLE NO. 11 [Volume = 1,250,000 kg/ha/m]										SAMPLE NO. 12 [Volume = 1,250,000 kg/ha/m]									
INORGANIC COMPOUNDS Micro's and Macro's	[5] Acc. Risk Value (WE&&A) ppb	TOTAL ANALYSIS			[4] PROBIT MODEL		TCLP EXTRACTION			[4] PROBIT MODEL		TOTAL ANALYSIS			[4] PROBIT MODEL		TCLP EXTRACTION			[4] PROBIT MODEL	
		[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[1] Lab Conc ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR
Aluminium as Al	[illegible]	7700	6352500	R	1.00E+02	R	1.6	1320	AR	2.22E-14	AR	9000	7425000	R	1.00E+02	R	0.3	248	AR	0.00E+00	AR
Arsenic as As	130	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR
Barium as Ba	[illegible]	18	14850	R	5.94E-02	R	0.31	256	AR	0.00E+00	AR	2.6	2145	AR	2.37E-10	AR	0.45	371	AR	0.00E+00	AR
Cadmium as Cd	31	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR
Chromium^{3+} as Cr^{3+}	[illegible]	100	82500	R	8.64E+01	R	< 0.04	0.00	AR	0.00E+00	AR	110	90750	R	9.01E+01	R	< 0.04	0.00	AR	0.00E+00	AR
Cobalt as Co	[illegible]	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR
Copper as Cu	[illegible]	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR
Iron as Fe	[illegible]	8100	6682500	R	1.00E+02	R	48	39600	R	5.43E+00	R	8900	7342500	R	1.00E+02	R	46	37950	R	4.57E+00	R
Lead as Pb	[illegible]	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+0	AR
Manganese as Mn	[illegible]	120	99000	R	1.00E+02	R	18	14850	R	9.99E+01	R	58	47850	R	1.00E+02	R	4.2	3465	R	6.11E+01	R
Mercury as Hg	[illegible]	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+0	AR
Nickel as Ni	[illegible]	< 10	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+0	AR
Selenium as Se	[illegible]	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+0	AR
Titanium as Ti	[illegible]	510	420750	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR	810	668250	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR
Vanadium as V	[illegible]	14	11550	R	4.09E+01	R	< 0.37	0.00	AR	0.00E+00	AR	25	20625	R	8.17E+01	R	< 0.07	0.00	AR	0.00E+00	AR
Zinc as Zn	[illegible]	46	37950	R	1.00E+02	R	< 0.17	0.00	AR	0.00E+00	AR	22.8	18810	R	9.73E+01	R	< 0.17	0.00	AR	0.00E+0	AR
Calcium as Ca	[illegible]	120	99000	AR	5.88E-06	AR	1960	1617000	R	5.58E+01	R	1100	907500	R	1.63E+01	R	270	222750	R	9.69E-03	R
Chloride as Cl	[illegible]	300	247500	AR	3.15E-04	AR	20	16500	AR	0.00E+00	AR	600	495000	R	7.75E-02	R	50	41250	AR	3.55E-13	AR
Fluoride as F	1500	1.38	1139	AR	2.47E-05	AR	1.2	990	AR	5.88E-06	AR	1.09	899	AR	2.12E-06	AR	0.5	413	AR	2.41E-10	AR
Magnesium as Mg	[illegible]	2700	2227500	R	9.88E+01	R	48	39600	AR	1.14E-06	AR	800	660000	R	4.54E+01	R	13	10725	AR	1.33E-13	AR
Potassium as K	[illegible]	1600	1320000	R	2.08E+01	R	50	41250	AR	6.25E-12	AR	1100	907500	R	6.13E+00	R	28	23100	AR	0.00E+00	AR
Sodium as Na	[illegible]	1100	907500	R	4.25E+01	R	NA	0.00	AR	0.00E+00	AR	800	660000	R	2.08E+01	R	NA	0.00	AR	0.00E+00	AR
Sulphate as SO_4	[illegible]	100	82500	AR	3.20E-08	AR	< 1.0	0.00	AR	0.00E+00	AR	150	123750	AR	2.98E-06	AR	< 1.0	0.00	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				R		R			R		R			R		R			R		R

Draft for discussion
CONFIDENTIAL
Research for IVS

TABLES 95 - 98

EVAPORATION DAM 1: SEDIMENTS INORGANIC HUMAN RISK ASSESSMENT

TABLES 99 - 100

EVAPORATION DAM 1: SEDIMENTS ORGANIC ENVIRONMENTAL RISK ASSESSMENT

Table 95

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO. 9 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 9

INORGANIC COMPOUNDS Micro's and Macro's	[5] RfD/ ADNGV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN							
			TOTAL ANALYSIS				TCLP EXTRACTION			
			[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	4700	3877500	129	2585000	0.83	685	0.023	457
Arsenic as As	0.0003	EPA RfD	< 50	0.00	0.00	0.00	< 0.34	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	12.0	9900	0.330	471	0.51	421	0.014	20
Cadmium as Cd	0.0005	EPA RfD	< 10	0.00	0.00	0.00	< 0.03	0.00	0.00	0.00
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	61	50325	1.68	112	< 0.04	0.00	0.00	0.00
Cobalt as Co	0.006	RSA RfD	< 13	0.00	0.00	0.00	< 0.12	0.00	0.00	0.00
Copper as Cu	0.01	EPA RfD	< 13	0.00	0.00	0.00	< 0.02	0.00	0.00	0.00
Iron as Fe	0.004	RSA RfD	4000	3300000	110	3666667	16	13200	0.440	14667
Lead as Pb	0.002	RSA RfD	< 100	0.00	0.00	0.00	< 0.31	0.00	0.00	0.00
Manganese as Mn	0.046	EPA RfD	300	247500	8.25	17935	11	9075	0.303	658
Mercury as Hg	0.0003	EPA RfD	0.00	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	12	9900	0.330	1650	< 0.05	0.00	0.00	0.00
Selenium as Se	0.005	EPA RfD	0.00	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	220	181500	6.05	201667	< 0.02	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	21	17325	0.578	6417	< 0.07	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	37	30525	1.0	339	< 0.17	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	330	272250	9.08	182	1900	1567500	52.25	1045
Chloride as Cl	3.3	RSA RfD	200	165000	5.50	166.3	50	41250	1.38	41.6
Fluoride as F	0.06	EPA RfD	1.04	858	0.029	47.7	1.2	990	0.033	55
Magnesium as Mg	2.3	RSA RfD	5100	4207500	140	6098	140	115500	3.85	167
Potassium as K	0.7	RSA RfD	1300	1072500	35.8	5114	48	39600	1.32	18.9
Sodium as Na	2.3	RSA RfD	3000	2475000	82.5	2500	NA	0.00	0.00	0.00
Sulphate as SO_4	6.7	RSA RfD	250	206250	6.88	103	< 1.0	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Groundwater	R			Groundwater	R	

Table 96

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO. 10 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 10

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ TDI/ ADI mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN							
			TOTAL ANALYSIS				TCLP EXTRACTION			
			[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	15000	12375000	413	8250000	0.11	91	0.003	66.7
Arsenic as As	0.0003	EPA RfD	< 50	0.00	0.00	0.00	< 0.34	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	19.0	15675	0.523	746	0.47	388	0.013	18.5
Cadmium as Cd	0.0005	EPA RfD	< 10	0.00	0.00	0.00	< 0.03	0.00	0.00	0.00
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	62	51150	1.71	114	< 0.04	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	10	8250	0.275	3438	< 0.12	0.00	0.00	0.00
Copper as Cu	0.04	EPA RfD	< 10	0.00	0.00	0.00	< 0.02	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	8100	6682500	223	7425000	90	74250	2.48	82500
Lead as Pb	0.002	RSA RfD	< 100	0.00	0.00	0.00	< 0.31	0.00	0.00	0.00
Manganese as Mn	0.046	EPA RfD	150	123750	4.13	8967	11	9075	0.303	658
Mercury as Hg	0.0003	EPA RfD	0.00	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	< 10	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Selenium as Se	0.005	EPA RfD	0.00	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	100	82500	2.75	91667	< 0.02	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	< 10	0.00	0.00	0.00	< 0.07	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	32	26400	0.880	293	< 0.17	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	75	61875	2.06	41.3	620	511500	17.05	341
Chloride as Cl	8.3	RSA RfD	300	247500	8.25	99.4	10	8250	0.28	3.4
Fluoride as F	0.06	EPA RfD	1.5	1238	0.041	68.8	3.0	2475	0.083	138
Magnesium as Mg	2.3	RSA RfD	1100	907500	30.3	1315	19	15675	0.52	23
Potassium as K	6.7	RSA RfD	1600	1320000	44.0	657	37	30525	1.02	15.2
Sodium as Na	3.3	RSA RfD	2000	1650000	55.0	1667	NA	0.00	0.00	0.00
Sulphate as SO_4	6.7	RSA RfD	300	247500	8.25	123	< 1.0	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN					Groundwater	R			Groundwater	R

Table 97

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO. 11 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 11

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN							
			TOTAL ANALYSIS				TCLP EXTRACTION			
			[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDi groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	7700	6352500	212	4235000	1.60	1320	0.044	880
Arsenic as As	0.0003	EPA RfD	< 50	0.00	0.00	0.00	< 0.34	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	18.0	14850	0.495	707	0.31	256	0.009	12.7
Cadmium as Cd	0.0005	EPA RfD	< 10	0.00	0.00	0.00	< 0.03	0.00	0.00	0.00
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	100	82500	2.75	183	< 0.04	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	< 10	0.00	0.00	0.00	< 0.12	0.00	0.00	0.00
Copper as Cu	0.04	EPA RfD	< 10	0.00	0.00	0.00	< 0.02	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	8100	6682500	223	7425000	48	39600	1.320	44000
Lead as Pb	0.002	RSA RfD	< 100	0.00	0.00	0.00	< 0.31	0.00	0.00	0.00
Manganese as Mn	0.019	EPA RfD	120	99000	3.30	717	18	14850	0.495	1070
Mercury as Hg	0.0003	EPA RfD	0.00	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	< 10	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Selenium as Se	0.005	EPA RfD	0.00	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	510	420750	14.03	467500	< 0.02	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	14	11550	0.385	4278	< 0.07	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	46	37950	1.3	422	< 0.17	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	120	99000	3.30	66.0	1960	1617000	53.90	1078
Chloride as Cl	8.3	RSA RfD	300	247500	8.25	99.4	20	16500	0.55	6.6
Fluoride as F	0.05	EPA RfD	1.38	1139	0.038	63.3	1.2	990	0.033	55
Magnesium as Mg	2.3	RSA RfD	2700	2227500	74.3	3228	48	39600	1.32	57
Potassium as K	6.7	RSA RfD	1600	1320000	44.0	657	50	41250	1.38	20.5
Sodium as Na	3.3	RSA RfD	1100	907500	30.3	917	NA	0.00	0.00	0.00
Sulphate as SO_4	0.7	RSA RfD	100	82500	2.75	41	< 1.0	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Groundwater		R		Groundwater		R

Table 98

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO. 12 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 12

INDRGANIC COMPDUNDS Micro's and Macro's	RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN							
			TOTAL ANALYSIS				TCLP EXTRACTION			
			[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	9000	7425000	248	4950000	0.30	248	0.008	165
Arsenic as As	0.0003	EPA RfD	< 50	0.00	0.00	0.00	< 0.34	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	2.6	2145	0.072	102	0.45	371	0.012	17.7
Cadmium as Cd	0.0005	EPA RfD	< 10	0.00	0.00	0.00	< 0.03	0.00	0.00	0.00
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	110	90750	3.03	202	< 0.04	0.00	0.00	0.00
Cobalt as Co	0.03	RSA RfD	< 10	0.00	0.00	0.00	< 0.12	0.00	0.00	0.00
Copper as Cu	0.02	EPA RfD	< 10	0.00	0.00	0.00	< 0.02	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	8900	7342500	245	8158333	46	37950	1.27	42167
Lead as Pb	0.002	RSA RfD	< 100	0.00	0.00	0.00	< 0.31	0.00	0.00	0.00
Manganese as Mn	0.046	EPA RfD	58	47850	1.60	3467	4.2	3465	0.116	251
Mercury as Hg	0.0003	EPA RfD	0.00	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	< 10	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Selenium as Se	0.005	EPA RfD	0.00	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Titanium as Ti	0.009	RSA RfD	810	668250	22.3	742500	< 0.02	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	25	20625	0.688	7639	< 0.07	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	22.8	18810	0.627	209	< 0.17	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	1100	907500	30.25	605	270	222750	7.43	149
Chloride as Cl	5.3	RSA RfD	600	495000	16.5	199	50	41250	1.38	16.6
Fluoride as F	0.15	EPA RfD	1.09	899	0.030	48.9	0.5	413	0.014	22.9
Magnesium as Mg	2.1	RSA RfD	800	660000	22	957	13	10725	0.358	15.6
Potassium as K	0.7	RSA RfD	1100	907500	30.3	451	28	23100	0.770	11.5
Sodium as Na	3.3	RSA RfD	300	660000	22.0	667	NA	0.00	0.00	0.00
Sulphate as SO_4	6.3	RSA RfD	150	123750	4.13	62	< 1.0	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Groundwater	R			Groundwater	R	

Table 99

EVAPORATION DAM 1: - ENVIRONMENTAL RISK QUANTIFICATION • SEDIMENTS • SAMPLE NO's 9, 10 & 11 (ORGANICS - PAH & VOC)

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBERS: 9, 10 & 11

ORGANIC COMPOUNDS Volatile & Semi-Volatile	RISK TO ENVIRONMENT - RISK OF SEDIMENTS FOR GROUNDWATER														
	SAMPLE NO. 9					SAMPLE NO. 10					SAMPLE NO. 11				
	TOTAL ANALYSIS			[4] PROBIT MODEL		TOTAL ANALYSIS			[4] PROBIT MODEL		TOTAL ANALYSIS			[4] PROBIT MODEL	
	[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR
Benzene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Toluene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Ethylbenzene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
m,p-Xylene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
o-Xylene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Styrene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Isopropylbenzene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
1,3,5-Trimethylbenzene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
1,2,4-Trimethylbenzene	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Naphthalene	0.12	99	AR	1.08E-11	AR	0.1	83	AR	1.12E-12	AR	< 0.01	0.00	AR	0.00E+00	AR
Phenol	0.23	190	AR	0.00E+00	AR	0.09	74.3	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR
2-Methylphenol	0.00	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR
4-Methylphenol	0.00	0.00	AR	0.00E+00	AR	0.22	182	AR	1.11E-14	AR	0.00	0.00	AR	0.00E+00	AR
2,4-Dimethylphenol	0.00	0.00	AR	0.00E+00	AR	0.31	256	AR	4.66E-12	AR	0.00	0.00	AR	0.00E+00	AR
2-Methylnapthalene	0.00	0.00	AR	0.00E+00	AR	0.28	231	R	1.28E-02	R	0.10	82.5	AR	8.34E-07	AR
Acenaphthylene	0.00	0.00	AR	0.00E+00	AR	0.46	380	R	1.00E+02	R	0.00	0.00	AR	0.00E+00	AR
Acenapthene	0.00	0.00	AR	0.00E+00	AR	0.74	611	R	2.28E+00	R	0.00	0.00	AR	0.00E+00	AR
Dibenzofuran	0.00	0.00	AR	0.00E+00	AR	0.93	767	R	3.81E+00	R	0.15	124	AR	5.14E-06	AR
Fluorene	0.00	0.00	AR	0.00E+00	AR	1.3	1073	R	2.17E+01	R	0.27	223	R	5.89E-03	R
Phenanthrene	0.00	0.00	AR	0.00E+00	AR	2.2	1815	R	9.45E+01	R	0.37	305	R	2.98E+00	R
Anthracene	0.00	0.00	AR	0.00E+00	AR	1.2	990	R	1.00E+02	R	0.18	149	R	1.00E+02	R
Carbazole	0.00	0.00	AR	0.00E+00	AR	2.3	1898	R	7.70E+01	R	1.5	1238	R	4.62E+01	R
Fluoranthene	0.17	140	R	5.00E+01	R	9.0	7425	R	1.00E+02	R	1.2	990	R	1.00E+02	R
Pyrene	0.12	99	AR	2.59E-07	AR	6.0	4950	R	9.62E+01	R	0.67	553	R	6.00E-01	R
Benzo[a]anthracene	0.00	0.00	AR	0.00E+00	AR	2.1	1733	R	1.00E+02	R	0.29	239	R	1.00E+02	R
Chrysene	0.00	0.00	AR	0.00E+00	AR	2.1	1733	R	8.59E+01	R	0.36	297	R	8.83E-01	R
bis(2-Ethylhexyl)phthalate	0.00	0.00	AR	0.00E+00	AR	0.43	355	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR
Benzo[b]+[k]fluoranthene	0.00	0.00	AR	0.00E+00	AR	3.1	2558	R	1.00E+02	R	0.58	479	R	1.00E+02	R
Benzo[a]pyrene	0.00	0.00	AR	0.00E+00	AR	1.4	1155	R	1.00E+02	R	0.23	190	R	1.00E+02	R
Indeno[1,2,3-cd]pyrene	0.00	0.00	AR	0.00E+00	AR	1.1	908	R	1.00E+02	R	0.20	165	R	1.00E+02	R
Dibenz[a,h]anthracene	0.00	0.00	AR	0.00E+00	AR	0.18	149	R	9.95E-03	R	0.00	0.00	AR	0.00E+00	AR
Benzo[g,h,i]perylene	0.00	0.00	AR	0.00E+00	AR	0.71	586	AR	2.22E-05	AR	0.13	107	AR	3.33E-14	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT			R		R			R		R			R		R

Table 100

EVAPORATION DAM 1: - ENVIRONMENTAL RISK QUANTIFICATION • SEDIMENTS • SAMPLE NO. 12 (ORGANICS - PAH & VOC)

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 12

ORGANIC COMPOUNDS Volatile & Semi-Volatile	[5] Acc. Risk Value (MR) ppb	RISK TO ENVIRONMENT — RISK OF SEDIMENTS FOR GROUNDWATER — SAMPLE NO. 12 — TOTAL ANALYSIS [1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	[4] PROBIT MODEL Risk Quantification	[3] Risk R / AR	NOTES
Benzene	3000	<0.01	0.00	AR	0.00E+00	AR	
Toluene	4500	<0.01	0.00	AR	0.00E+00	AR	
Ethylbenzene	3570	<0.01	0.00	AR	0.00E+00	AR	
m,p-Xylene	970	<0.01	0.00	AR	0.00E+00	AR	
o-Xylene	1450	<0.01	0.00	AR	0.00E+00	AR	
Styrene	4360	<0.01	0.00	AR	0.00E+00	AR	
Isopropylbenzene	2640	<0.01	0.00	AR	0.00E+00	AR	
1,3,5-Trimethylbenzene	1260	<0.01	0.00	AR	0.00E+00	AR	
1,2,4-Trimethylbenzene	770	<0.01	0.00	AR	0.00E+00	AR	
Naphthalene	460	<0.01	0.00	AR	0.00E+00	AR	
Phenol	2690	0.12	99	AR	0.00E+00	AR	
2-Methylphenol	1460	0.00	0.00	AR	0.00E+00	AR	
4-Methylphenol	1470	0.43	355	AR	4.65E-11	AR	
2,4-Dimethylphenol	1270	0.00	0.00	AR	0.00E+00	AR	
2-Methylnapthalene	150	0.00	0.00	AR	0.00E+00	AR	
Acenaphthylene	0.5	0.00	0.00	AR	0.00E+00	AR	
Acenapthene	170	0.00	0.00	AR	0.00E+00	AR	
Dibenzofuran	190	0.00	0.00	AR	0.00E+00	AR	
Fluorene	160	0.00	0.00	AR	0.00E+00	AR	
Phenanthrene	80	0.00	0.00	AR	0.00E+00	AR	
Anthracene	0.5	0.00	0.00	AR	0.00E+00	AR	
Carbazole	130	0.00	0.00	AR	0.00E+00	AR	
Fluoranthene	14	0.18	149	R	5.49E+01	R	
Pyrene	200	0.12	99	AR	2.59E-07	AR	
Benzo[a]anthracene	1.0	0.00	0.00	AR	0.00E+00	AR	
Chrysene	100	0.00	0.00	AR	0.00E+00	AR	
bis(2-Ethylhexyl)phthalate	14400	0.00	0.00	AR	0.00E+00	AR	
Benzo[b]+[k]fluoranthene	0.5	0.00	0.00	AR	0.00E+00	AR	
Benzo[a]pyrene	0.5	0.00	0.00	AR	0.00E+00	AR	
Indeno[1,2,3-cd]pyrene	0.5	0.00	0.00	AR	0.00E+00	AR	
Dibenz[a,h]anthracene	100	0.00	0.00	AR	0.00E+00	AR	
Benzo[g,h,i]perylene	700	0.00	0.00	AR	0.00E+00	AR	
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				R		R	

Volume = 1,250,000 kg/ha/m

TABLES 101 - 102

EVAPORATION DAM 1: SEDIMENTS ORGANIC
HUMAN RISK ASSESSMENT

Table 101

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO's 9 & 10 [ORGANIC - PAHs & VOCs] - IVS - MASTER PLAN

SAMPLE NUMBERS: 9 & 10			RISK TO HUMAN							
			SAMPLE NO. 9				SAMPLE NO. 10			
ORGANIC COMPOUNDS Volatile & Semi-Volatile	[5] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Benzene	0.002	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Toluene	0.2	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Ethylbenzene	0.1	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
m,p-Xylene	0.18	WHO GV	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
o-Xylene	0.17	WHO GV	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Styrene	0.2	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Isopropylbenzene	0.1	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
1,3,5-Trimethylbenzene	0.05	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.05	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Naphthalene	0.02	EPA RfD	0.12	99	0.003	16.5	0.1	83	0.003	13.8
Phenol	0.6	EPA RfD	0.23	190	0.006	1.06	0.09	74.3	0.002	0.413
2-Methylphenol	0.05	EPA RfD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.00	0.00	0.00	0.00	0.22	182	0.006	121
2,4-Dimethylphenol	0.02	EPA RfD	0.00	0.00	0.00	0.00	0.31	256	0.009	42.7
2-Methylnaphthalene	0.04	EPA RfD	0.00	0.00	0.00	0.00	0.28	231	0.008	38.5
Acenaphthylene	0.000025	WHO GV	0.00	0.00	0.00	0.00	0.46	380	0.013	63333
Acenaphthene	0.1	EPA RfD	0.00	0.00	0.00	0.00	0.74	611	0.020	33.9
Oibenzofuran	0.004	EPA RfD	0.00	0.00	0.00	0.00	0.93	767	0.026	639
Fluorene	0.04	EPA RfD	0.00	0.00	0.00	0.00	1.3	1073	0.036	90.4
Phenanthrene	0.0002	WHO GV	0.00	0.00	0.00	0.00	2.2	1815	0.061	30250
Anthracene	0.3	EPA RfD	0.00	0.00	0.00	0.00	1.2	990	0.033	11.0
Carbazole	0.006	EPA RfD	0.00	0.00	0.00	0.00	2.3	1898	0.063	1054
Fluoranthene	0.04	EPA RfD	0.17	140	0.005	11.7	9.0	7425	0.248	619
Pyrene	0.03	EPA RfD	0.12	99	0.003	11.0	6.0	4950	0.165	550
Benzo[e]anthracene	0.000002	WHO GV	0.00	0.00	0.00	0.00	2.1	1733	0.058	288833
Chrysene	0.000002	WHO GV	0.00	0.00	0.00	0.00	2.1	1733	0.058	288833
bis(2-Ethylhexyl)phthalate	0.02	EPA RfD	0.00	0.00	0.00	0.00	0.43	355	0.012	59.2
Benzo[b]+[k]fluoranthene	0.000002	WHO GV	0.00	0.00	0.00	0.00	3.1	2558	0.085	426333
Benzo[a]pyrene	0.0002	WHO GV	0.00	0.00	0.00	0.00	1.4	1155	0.039	19250
Indeno[1,2,3-cd]pyrene	0.000002	WHO GV	0.00	0.00	0.00	0.00	1.1	908	0.030	151333
Dibenz[a,h]anthracene	0.000015	WHO GV	0.00	0.00	0.00	0.00	0.18	149	0.005	2483
Benzo[g,h,i]perylene	0.0002	WHO GV	0.00	0.00	0.00	0.00	0.71	586	0.020	9767
RISK / ACCEPTABLE RISK TO: HUMAN					Groundwater	AR			Groundwater	R

Table 102

EVAPORATION DAM 1: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO's 11 & 12 [ORGANIC - PAHs & VOCs] - IVS - MASTER PLAN

SAMPLE NUMBERS: 11 & 12			RISK TO HUMAN							
			SAMPLE NO. 11				SAMPLE NO. 12			
ORGANIC COMPOUNDS Volatile & Semi-Volatile	RfD/ ADI/GV mg/(kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Benzene	0.002	EPA RfD	< 0.01	0.0	0.00	0.00	< 0.01	0.00	0.00	0.00
Toluene	0.2	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Ethylbenzene	0.1	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
m,p-Xylene	0.18	WHO GV	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
o-Xylene	0.17	WHO GV	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Styrene	0.2	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Isopropylbenzene	0.1	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
1,3,5-Trimethylbenzene	0.05	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.05	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Naphthalene	0.02	EPA RfD	< 0.01	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.00	0.00	0.00	0.00	0.12	99	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.00	0.00	0.00	0.00	0.43	355	0.012	237
2,4-Dimethylphenol	0.02	EPA RfD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylnaphthalene	0.02	EPA RfD	0.10	82.5	0.0028	13.8	0.00	0.00	0.00	0.00
Acenaphthylene	0.0002	WHO GV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acenaphthene	0.1	EPA RfD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dibenzofuran	0.004	EPA RfD	0.15	124	0.0041	103	0.00	0.00	0.00	0.00
Fluorene	0.04	EPA RfD	0.27	223	0.007	18.5	0.00	0.00	0.00	0.00
Phenanthrene	0.0002	WHO GV	0.37	305	0.010	5083	0.00	0.00	0.00	0.00
Anthracene	0.3	EPA RfD	0.18	149	0.005	1.7	0.00	0.00	0.00	0.00
Carbazole	0.005	EPA RfD	1.5	1238	0.041	688	0.00	0.00	0.00	0.00
Fluoranthene	0.04	EPA RfD	1.2	990	0.033	82.5	0.18	149	0.005	12.4
Pyrene	0.03	EPA RfD	0.67	553	0.018	61.4	0.12	99	0.003	11.0
Benzo[a]anthracene	0.0002	WHO GV	0.29	239	0.008	39833	0.00	0.00	0.00	0.00
Chrysene	0.00002	WHO GV	0.36	297	0.010	49500	0.00	0.00	0.00	0.00
bis(2-Ethylhexyl)phthalate	0.02	EPA RfD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzo[b]+[k]fluoranthene	0.00002	WHO GV	0.58	479	0.016	79833	0.00	0.00	0.00	0.00
Benzo[a]pyrene	0.00002	WHO GV	0.23	190	0.006	3167	0.00	0.00	0.00	0.00
Indeno[1,2,3-cd]pyrene	0.00002	WHO GV	0.20	165	0.006	27500	0.00	0.00	0.00	0.00
Dibenz[a,h]anthracene	0.0002	WHO GV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzo[g,h,i]perylene	0.0002	WHO GV	0.13	107	0.004	1783	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN					Groundwater	R			Groundwater	R

Appendix 2 continued

EVAPORATION DAM 2
ENVIRONMENTAL RISK QUANTIFICATION AND HUMAN RISK ASSESSMENT SUMMARY TABLES

TABLES 103 - 105

EVAPORATION DAM 2: WATERS INORGANIC ENVIRONMENTAL RISK QUANTIFICATION

Table 103

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 16 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 16 — EVAPORATION DAM 2: — Current Volume = 316,297 kg/ha/m (Current & Total volumes are the same)

INORGANIC COMPOUNDS Micro's and Macro's	Acc. Risk Value (MR&SA) ppb	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER							
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL	
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR
Aluminium as Al	10000	0.184	184	AR	0.00E+00	AR	6.1	AR	0.00E+00	AR	38.4	AR	0.00E+00	AR				
Arsenic as As	430	0.013	13.0	AR	0.00E+00	AR	0.433	AR	0.00E+00	AR	2.71	AR	0.00E+00	AR				
Barium as Ba	7800	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cadmium as Cd	31	0.035	35	R	1.02E-03	R	1.17	AR	0.00E+00	AR	7.3	R*	3.44E-11	R*				
Chromium^{3+} as Cr^{3+}	4700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Chromium^{6+} as Cr^{6+}	[illegible]	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cobalt as Co	6900	0.071	71	AR	0.00E+00	AR	2.37	AR	0.00E+00	AR	14.8	AR	0.00E+00	AR				
Copper as Cu	100	0.028	28	AR	2.97E-10	AR	0.933	AR	0.00E+00	AR	5.85	AR	0.00E+00	AR				
Cyanide as CN	5.3	< 0.05	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Iron as Fe	9000	0.518	518	AR	0.00E+00	AR	17.3	AR	0.00E+00	AR	108	AR	0.00E+00	AR				
Lead as Pb	100	0.182	182	R	4.35E-02	R	6.1	AR	0.00E+00	AR	38	AR	1.22E-08	AR				
Manganese as Mn	[illegible]	0.123	123	AR	2.98E-08	AR	4.1	AR	0.00E+00	AR	26	AR	0.00E+00	AR				
Mercury as Hg	[illegible]	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	Current & Total Volumes are the same			
Nickel as Ni	[illegible]	0.107	107	AR	0.00E+00	AR	3.57	AR	0.00E+00	AR	22.3	AR	0.00E+00	AR				
Selenium as Se	260	< 0.005	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Titanium as Ti	[illegible]	0.51	510	AR	1.05E-05	AR	17.0	AR	0.00E+00	AR	106	AR	6.66E-14	AR				
Vanadium as V	1300	0.03	30	AR	0.00E+00	AR	1.0	AR	0.00E+00	AR	6.26	AR	0.00E+00	AR				
Zinc as Zn	700	0.05	50	AR	0.00E+00	AR	1.7	AR	0.00E+00	AR	10.4	AR	0.00E+00	AR				
Calcium as Ca	150000	40	40000	AR	1.62E-10	AR	1333	AR	0.00E+00	AR	8350	AR	0.00E+00	AR				
Chloride as Cl	250000	1687	1687000	R	2.21E+01	R	56233	AR	1.89E-11	AR	352171	R	6.41E-03	R				
Fluoride as F	1500	12.8	12800	R	3.78E+01	R	427	AR	3.61E-10	AR	2672	R	3.74E-02	R				
Magnesium as Mg	70000	22	22000	AR	1.23E-09	AR	733	AR	0.00E+00	AR	4593	AR	0.00E+00	AR				
Potassium as K	200000	481	481000	R	2.68E-01	R	16033	AR	0.00E+00	AR	100412	AR	3.03E-07	AR				
Sodium as Na	100000	2810	2810000	R	9.78E+01	R	93667	AR	1.89E-04	AR	586604	R	1.49E+01	R				
Sulphate as SO_4	200000	4389	4389000	R	9.38E+01	R	146300	AR	1.70E-05	AR	916230	R	6.36E+00	R				
Boron as B	47000	2.8	2800	AR	3.44E-13	AR	93.3	AR	0.00E+00	AR	585	AR	0.00E+00	AR				
Nitrate as N	[illegible]	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R				AR		AR		R		R				

Table 104

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 17 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 17

INORGANIC COMPOUNDS Micro's and Macro's	Acc. Risk Value	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER						
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification %	[3] Risk R / AR
Aluminium as Al	5000000	0.221	221	AR	0.00E+00	AR	7.37	AR	0.00E+00	AR	46.1	AR	0.00E+00	AR				
Arsenic as As	430	0.014	14.0	AR	0.00E+00	AR	0.467	AR	0.00E+00	AR	2.92	AR	0.00E+00	AR				
Barium as Ba	7800	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cadmium as Cd	31	0.035	35	R	1.02E-03	R	1.17	AR	0.00E+00	AR	7.3	R*	3.44E-11	R*				
Chromium^{3+} as Cr^{3+}	4700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Chromium^{6+} as Cr^{6+}	32	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cobalt as Co	1900	0.075	75	AR	0.00E+00	AR	2.50	AR	0.00E+00	AR	15.7	AR	0.00E+00	AR				
Copper as Cu	100	0.029	29	AR	4.59E-10	AR	0.967	AR	0.00E+00	AR	6.05	AR	0.00E+00	AR				
Cyanide as CN	52	< 0.05	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Iron as Fe	300000	0.530	530	AR	0.00E+00	AR	17.7	AR	0.00E+00	AR	111	AR	0.00E+00	AR				
Lead as Pb	180	0.179	179	R	3.87E-02	R	6.0	AR	0.00E+00	AR	37	AR	1.01E-08	AR				
Manganese as Mn	3000	0.132	132	AR	6.76E-08	AR	4.4	AR	0.00E+00	AR	28	AR	0.00E+00	AR				
Mercury as Hg	22	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	Current & Total Volumes are the same			
Nickel as Ni	1140	0.115	115	AR	0.00E+00	AR	3.83	AR	0.00E+00	AR	24	AR	0.00E+00	AR				
Selenium as Se	200	< 0.005	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Titanium as Ti	731	0.50	500	AR	8.53E-06	AR	16.7	AR	0.00E+00	AR	104	AR	5.55E-14	AR				
Vanadium as V	1.0	< 0.03	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Zinc as Zn	700	0.048	48	AR	0.00E+00	AR	1.6	AR	0.00E+00	AR	10	AR	0.00E+00	AR				
Calcium as Ca	1500000	40	40000	AR	1.62E-10	AR	1333	AR	0.00E+00	AR	8350	AR	0.00E+00	AR				
Chloride as Cl	250000	1737	1737000	R	2.36E+01	R	57900	AR	2.74E-11	AR	362609	R	8.07E-03	R				
Fluoride as F	1200	12.9	12900	R	3.84E+01	R	430	AR	3.97E-10	AR	2693	R	3.95E-02	R				
Magnesium as Mg	70000	23	23000	AR	2.12E-09	AR	767	AR	0.00E+00	AR	4801	AR	0.00E+00	AR				
Potassium as K	200000	474	474000	R	2.45E-01	R	15800	AR	0.00E+00	AR	98950	AR	2.57E-07	AR				
Sodium as Na	100000	2780	2780000	R	9.77E+01	R	92667	AR	1.71E-04	AR	580342	R	1.44E+01	R				
Sulphate as SO_4	200000	4333	4333000	R	9.35E+01	R	144433	AR	1.49E-05	AR	904540	R	6.05E+00	R				
Boron as B	17000	1.8	1800	AR	0.00E+00	AR	60	AR	0.00E+00	AR	376	AR	0.00E+00	AR				
Nitrate as N	3000	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
RISK / ACCEPTABLE RISK TO: ENVIRONMENT				R		R		AR		AR		R		R				

Table 105

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO. 18 [ORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 18

INORGANIC COMPOUNDS Micro's and Macro's	[5] Acc. Risk Value (MR&SA) ppb	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNDWATER							
		TOTAL ANALYSIS			[4] PROBIT MODEL		DILUTED WATER		[4] PROBIT MODEL		CURRENT VOLUME		[4] PROBIT MODEL		TOTAL VOLUME		[4] PROBIT MODEL	
		[1] Lab Conc. ppm	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR	[2] EEC ppb	[3] Risk R / AR	Risk Quantification%	[3] Risk R / AR
Aluminium as Al	10000	0.239	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	49.9	AR	0.00E+00	AR				
Arsenic as As	430	0.007	7.0	AR	0.00E+00	AR	0.233	AR	0.00E+00	AR	1.46	AR	0.00E+00	AR				
Barium as Ba	7800	< 0.10	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cadmium as Cd	31	0.024	24	R*	3.00E-05	R*	0.80	AR	0.00E+00	AR	5.0	R*	2.67E-13	R*				
Chromium^{3+} as Cr^{3+}	4700	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Chromium^{6+} as Cr^{6+}	20	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cobalt as Co	2000	0.047	47	AR	0.00E+00	AR	1.57	AR	0.00E+00	AR	9.8	AR	0.00E+00	AR				
Copper as Cu	930	< 0.025	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Cyanide as CN	4	< 0.05	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Iron as Fe	56000	1.17	1170	AR	1.11E-14	AR	39	AR	0.00E+00	AR	244	AR	0.00E+00	AR				
Lead as Pb	100	0.117	117	R	1.39E-03	R	3.9	AR	0.00E+00	AR	24	AR	5.30E-11	AR				
Manganese as Mn	300	0.579	579	R	6.52E-02	R	19.3	AR	0.00E+00	AR	121	AR	2.46E-08	AR				
Mercury as Hg	2	< 0.002	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	Current & Total Volumes are the same			
Nickel as Ni	1140	0.070	70	AR	0.00E+00	AR	2.33	AR	0.00E+00	AR	15	AR	0.00E+00	AR				
Selenium as Se	280	0.008	8.0	AR	0.00E+00	AR	0.27	AR	0.00E+00	AR	1.70	AR	0.00E+00	AR				
Titanium as Ti	731	0.61	610	AR	6.27E-05	AR	20.3	AR	0.00E+00	AR	127	AR	6.88E-13	AR				
Vanadium as V	1300	< 0.03	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
Zinc as Zn	700	0.061	61	AR	0.00E+00	AR	2.0	AR	0.00E+00	AR	13	AR	0.00E+00	AR				
Calcium as Ca	150000	106	106000	AR	1.19E-05	AR	3533	AR	0.00E+00	AR	22128	AR	7.77E-14	AR				
Chloride as Cl	250000	1266	1266000	R	9.18E+00	R	42200	AR	4.66E-13	AR	264285	R	5.70E-04	R				
Fluoride as F	1500	8.6	8600	R	1.39E+01	R	287	AR	2.35E-12	AR	1795	R	1.68E-03	R				
Magnesium as Mg	70000	27	27000	AR	1.45E-08	AR	900	AR	0.00E+00	AR	5636	AR	0.00E+00	AR				
Potassium as K	200000	255	255000	R	2.86E-03	R	8500	AR	0.00E+00	AR	53233	AR	1.58E-10	AR				
Sodium as Na	100000	1767	1767000	R	8.67E+01	R	58900	AR	1.76E-06	AR	368872	R	2.56E+00	R				
Sulphate as SO_4	200000	2500	2500000	R	6.69E+01	R	83333	AR	3.59E-08	AR	521890	R	4.33E-01	R				
Boron as B	17000	1.8	1800	AR	0.00E+00	AR	60	AR	0.00E+00	AR	376	AR	0.00E+00	AR				
Nitrate as N	9000	< 0.2	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR	0.00	AR	0.00E+00	AR				
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R			AR		AR		R		R					

TABLES 106 – 108

EVAPORATION DAM 2: WATERS INORGANIC
HUMAN RISK ASSESSMENT

Table 106

EVAPORATION DAM 2: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 16 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJL - MASTER PLAN]

SAMPLE NUMBER: 16

INDRGANIC COMPDUNDS Micro's and Macro's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.184	0.0061	123	6.1	0.00020	4.07	38.4	0.0013	25.6
Arsenic as As	0.0003	EPA RfD	0.013	0.0004	147	0.433	0.000014	4.81	2.71	0.00009	30.1
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.035	0.0012	233	1.17	0.000039	7.8	7.31	0.00024	48.7
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.071	0.0024	29.6	2.37	0.00008	0.99	14.8	0.0005	6.17
Copper as Cu	0.04	EPA RfD	0.03	0.0009	2.3	0.93	0.00003	0.078	5.85	0.0002	0.488
Cyanide as CN	0.04	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	0.518	0.0173	576	17.3	0.00058	19.2	108	0.0036	120
Lead as Pb	0.002	RSA RfD	0.182	0.006	303	6.1	0.00020	10.2	38	0.0013	63.3
Manganese as Mn	0.046	EPA RfD	0.123	0.004	8.9	4.1	0.00014	0.297	25.7	0.0009	1.86
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.107	0.0036	17.9	3.57	0.00012	0.595	22.3	0.0007	3.72
Selenium as Se	0.005	EPA RfD	< 0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	0.51	0.017	567	17.0	0.00057	18.9	106	0.0035	118
Vanadium as V	0.009	EPA RfD	0.03	0.0010	11	1.0	0.00003	0.37	6.26	0.0002	2.32
Zinc as Zn	0.3	EPA RfD	0.05	0.0017	0.556	1.7	0.00006	0.019	10.4	0.0003	0.119
Calcium as Ca	5.0	RSA RfD	40	1.3	27	1333	0.044	0.889	8350	0.278	5.67
Chloride as Cl	8.3	RSA RfD	1687	56	678	56233	1.87	22.6	352171	11.74	141
Fluoride as F	0.06	EPA RfD	12.8	0.427	711	427	0.014	23.7	2672	0.089	148
Magnesium as Mg	2.3	RSA RfD	22	0.73	32	733	0.024	1.06	4593	0.153	6.7
Potassium as K	6.7	RSA RfD	481	16.0	239	16033	0.534	8.0	100412	3.35	50.0
Sodium as Na	3.3	RSA RfD	2810	94	2838	93667	3.12	95	586604	19.6	593
Sulphate as SO_4	6.7	RSA RfD	4389	146	2184	146300	4.88	73	916230	30.5	456
Boron as B	0.09	EPA RfD	2.8	0.093	104	93.3	0.0031	3.46	585	0.0195	21.7
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	42.0	0.0014	0.09
RISK / ACCEPTABLE RISK TO HUMAN				Dam water	R		River water	AR		Groundwater	R

Table 107

HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 17 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 17

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.221	0.0074	147	7.37	0.00025	4.91	46.1	0.0015	30.7
Arsenic as As	0.0003	EPA RfD	0.014	0.0005	156	0.467	0.000016	5.19	2.92	0.00010	32.4
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.035	0.00117	233	1.17	0.000039	7.80	7.31	0.00024	48.7
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.008	RSA RfD	0.075	0.0025	31.3	2.50	0.00008	1.04	15.7	0.00052	6.54
Copper as Cu	0.04	EPA RfD	0.03	0.0010	2.4	0.967	0.00003	0.081	6.05	0.00020	0.504
Cyanide as CN	0.04	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	0.530	0.0177	589	17.7	0.00059	19.7	111	0.0037	123
Lead as Pb	0.002	RSA RfD	0.179	0.006	298	6.0	0.00020	10.0	37.4	0.0012	62.3
Manganese as Mn	0.046	EPA RfD	0.132	0.004	9.6	4.4	0.00015	0.319	27.6	0.0009	2.0
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.115	0.0038	19.2	3.83	0.00013	0.638	24.0	0.0008	4.0
Selenium as Se	0.005	EPA RfD	< 0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	0.5	0.0167	556	16.7	0.00056	18.6	104	0.0035	116
Vanadium as V	0.009	EPA RfD	< 0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	0.048	0.0016	0.533	1.60	0.00005	0.018	10.0	0.0003	0.111
Calcium as Ca	5.0	RSA RfD	40	1.3	27	1333	0.04	0.889	8350	0.278	5.6
Chloride as Cl	8.3	RSA RfD	1737	58	698	57900	1.93	23.3	362609	12.1	146
Fluoride as F	0.06	EPA RfD	12.9	0.430	717	430	0.014	25.8	2693	0.090	150
Magnesium as Mg	2.3	RSA RfD	23	0.767	33	767	0.026	1.11	4801	0.160	7.0
Potassium as K	6.7	RSA RfD	474	15.8	236	15800	0.527	7.86	98950	3.3	49.2
Sodium as Na	3.3	RSA RfD	2780	93	2808	92667	3.09	93.6	580342	19.3	586
Sulphate as SO_4	6.7	RSA RfD	4333	144	2156	144433	4.81	71.9	904540	30.2	450
Boron as B	0.09	EPA RfD	1.8	0.060	66.7	60	0.0020	2.22	376	0.013	13.9
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		RISK / ACCEPTABLE RISK TO: HUMAN		Dam water	R		River water	AR		Groundwater	R

Table 108

EVALUATION DAM 2: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO. 16 [INORGANIC - MICRO'S & MACRO'S]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 18

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	0.239	0.0080	159	7.97	0.00027	5.31	49.9	0.0017	33.3
Arsenic as As	0.0003	EPA RfD	0.007	0.0002	70	0.233	0.000008	2.50	1.46	0.00005	16.7
Barium as Ba	0.07	EPA RfD	< 0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cadmium as Cd	0.0005	EPA RfD	0.024	0.0008	160	0.800	0.00003	6.0	5.00	0.00017	33.3
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chromium^{6+} as Cr^{6+}	0.003	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt as Co	0.002	RSA RfD	0.047	0.0016	78.5	1.57	0.00005	0.785	9.80	0.00033	16.5
Copper as Cu	0.04	EPA RfD	< 0.025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyanide as CN	0.02	EPA RfD	< 0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	1.170	0.039	1300	39.0	0.0013	43.3	244	0.0081	271
Lead as Pb	0.002	RSA RfD	0.117	0.004	195	3.9	0.0001	6.5	24.4	0.0008	40.7
Manganese as Mn	0.046	EPA RfD	0.579	0.019	42.0	19.3	0.0006	1.40	121	0.0040	8.77
Mercury as Hg	0.0003	EPA RfD	< 0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	0.07	0.0023	11.7	2.33	0.00008	0.389	14.6	0.0005	2.43
Selenium as Se	0.005	EPA RfD	0.008	0.0003	5.3	0.270	0.000009	0.180	1.70	0.00006	1.13
Titanium as Ti	0.003	RSA RfD	0.61	0.020	678	20.3	0.00068	22.6	127	0.004	141
Vanadium as V	0.009	EPA RfD	< 0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	0.061	0.0020	0.678	2.00	0.00007	0.022	12.7	0.0004	0.141
Calcium as Ca	5.0	RSA RfD	106	3.5	71	3533	0.118	2.4	22128	0.738	14.8
Chloride as Cl	8.3	RSA RfD	1266	42	508	42200	1.41	16.9	264285	8.81	106
Fluoride as F	0.06	EPA RfD	8.6	0.287	478	287	0.010	16.7	1795	0.060	100
Magnesium as Mg	2.3	RSA RfD	27	0.90	39	900	0.030	1.30	5636	0.188	8.2
Potassium as K	0.7	RSA RfD	255	8.5	127	8500	0.283	4.2	53233	1.77	26.5
Sodium as Na	3.3	RSA RfD	1767	59	1785	58900	1.96	59	368872	12.3	373
Sulphate as SO_4	6.7	RSA RfD	2500	83	1244	83333	2.78	41	521890	17.4	260
Boron as B	0.09	EPA RfD	1.8	0.060	66.7	60	0.0020	2.22	376	0.013	13.9
Nitrate as N	1.6	EPA RfD	< 0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Dam water	R		River water	R		Groundwater	R

TABLE 109

EVAPORATION DAM 2: WATERS ORGANIC ENVIRONMENTAL RISK QUANTIFICATION

Table 109

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • DAM WATER • SAMPLE NO's 16D, 17D & 18D [ORGANICS - PAH & VOC]

[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NUMBER: 16D

ORGANIC COMPOUNDS PAH[4] & VOC[5]	Acc. Risk Value (ARV) ug/l	RISK TO ENVIRONMENT															
		RISK OF DAM WATER AS IS					RISK OF DILUTED DAM WATER IN RIVER				RISK OF DAM WATER FOR GROUNOWATER						
		TOTAL ANALYSIS			[4]PROBIT MODEL		DILUTED WATER		[4]PROBIT MODEL		CURRENT VOLUME		[4]PROBIT MODEL		TOTAL VOLUME		[4]PROBIT MODEL
		[1]Lab Conc. ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR
Butylbenzylphthalate	530	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Phenol	2690	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2-Methylphenol	1460	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
4-Methylphenol	1470	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2,4-Dimethylphenol	1270	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		AR		AR		AR		AR		AR		AR		AR		AR		AR

SAMPLE NUMBER: 17D

Butylbenzylphthalate	530	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Phenol	2690	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2-Methylphenol	1460	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
4-Methylphenol	1470	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2,4-Dimethylphenol	1270	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		AR		AR		AR		AR		AR		AR		AR		AR		AR

SAMPLE NUMBER: 18D

Butylbenzylphthalate	530	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
bis(2-ethylhexyl)phthalate	14400	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Di-n-butylphthalate	200	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
Phenol	2690	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2-Methylphenol	1460	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
4-Methylphenol	1470	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
2,4-Dimethylphenol	1270	0.000	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR	0.00	AR	0.0E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		AR		AR		AR		AR		AR		AR		AR		AR		AR

TABLE 110

EVAPORATION DAM 2: WATERS ORGANIC
HUMAN RISK ASSESSMENT

Table 110

EVAPORATION DAM 2: HUMAN RISK ASSESSMENT • DAM WATER • SAMPLE NO's 16D, 17D & 18D - [ORGANICS - PAH's & VOC's]

[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 16D

ORGANIC COMPOUNDS PAH's & VOC's	[6] RfD/ ADI/GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN								
			RISK OF DAM WATER AS IS			RISK OF DILUTED DAM WATER IN RIVER			RISK OF DAM WATER FOR GROUNDWATER		
			[8] Conc. in Dam water ppm	[9] PDI Dam water exposure mg/kg/day	[10] Margin of Safety %	[11] Conc. in River water (EEC) ppb	[12] PDI river water exposure mg/kg/day	[10] Margin of Safety %	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-Dimethylphenol	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN			Dam water	AR		River water	AR		Groundwater	AR	

SAMPLE NUMBER: 17D

Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-Dimethylphenol	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN			Dam water	AR		River water	AR		Groundwater	AR	

SAMPLE NUMBER: 18D

Butylbenzylphthalate	0.2	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
bis(2-ethylhexyl)phthalate	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate	0.1	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phenol	0.6	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-Methylphenol	0.05	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-Methylphenol	0.005	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-Dimethylphenol	0.02	EPA RfD	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN			Dam water	AR		River water	AR		Groundwater	AR	

TABLES 111 - 112

EVAPORATION DAM 2: SEDIMENTS INORGANIC ENVIRONMENTAL RISK QUANTIFICATION

Table 111

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • SEDIMENTS • SAMPLE NO's: 16&17 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NO.: 16&17		RISK TO ENVIRONMENT																			
		RISK OF SEDIMENTS FOR GROUNDWATER																			
		SAMPLE NO. 16 VOLUME = 1,250,000 kg/ha/m										SAMPLE NO. 17 VOLUME = 1,250,000 kg/ha/m									
		TOTAL ANALYSIS			[4]PROBIT MODEL		TCLP EXTRACTION			[4]PROBIT MODEL		TOTAL ANALYSIS			[4]PROBIT MODEL		TCLP EXTRACTION			[4]PROBIT MODEL	
INORGANIC COMPOUNDS Micro's and Macro's	Rec. Risk Value (S/H&SA) ppb	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR
Aluminium as Al	10000	5300	4372500	R	1.00E+02	R	0.15	124	AR	0.00E+00	AR	11000	9075000	R	1.00E+02	R	0.3	248	AR	0.00E+00	AR
Arsenic as As	430	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR
Barium as Ba	7800	5.9	4868	AR	3.26E-06	AR	0.39	322	AR	0.00E+00	AR	17	14025	R	3.99E-02	R	0.4	330	AR	0.00E+00	AR
Cadmium as Cd	31	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR
Chromium^{3+} as Cr^{3+}	4700	51	42075	R	4.14E+01	R	< 0.04	0.00	AR	0.00E+00	AR	49	40425	R	3.84E+01	R	< 0.04	0.00	AR	0.00E+00	AR
Cobalt as Co	6900	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR
Copper as Cu	100	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR
Iron as Fe	9000	5200	4290000	R	1.00E+02	R	37	30525	R	1.73E+00	R	5500	4537500	R	1.00E+02	R	19	15675	R	3.18E-02	R
Lead as Pb	100	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR
Manganese as Mn	300	120	99000	R	1.00E+02	R	3.2	2640	R	4.01E+01	R	130	107250	R	1.00E+02	R	0.9	743	R	3.19E-01	R
Mercury as Hg	22	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR
Nickel as Ni	1140	11	9075	R	3.28E+01	R	< 0.05	0.00	AR	0.00E+00	AR	< 10	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR
Selenium as Se	260	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR
Titanium as Ti	731	550	453750	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR	380	313500	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR
Vanadium as V	1300	15	12375	R	4.62E+01	R	< 0.07	0.00	AR	0.00E+00	AR	13	10725	R	3.54E+01	R	< 0.07	0.00	AR	0.00E+00	AR
Zinc as Zn	700	30	24750	R	9.93E+01	R	< 0.17	0.00	AR	0.00E+00	AR	19	15675	R	9.42E+01	R	< 0.17	0.00	AR	0.00E+00	AR
Calcium as Ca	150000	2500	2062500	R	7.33E+01	R	200	165000	R	8.10E-04	R	170	140250	AR	1.86E-04	AR	57	47025	AR	1.20E-09	AR
Chloride as Cl	250000	100	82500	AR	2.23E-03	AR	50	41250	AR	3.55E-13	AR	400	330000	R	3.80E-03	R	90	74250	AR	6.16E-10	AR
Fluoride as F	1500	2.0	1650	R	8.10E-04	R	0.3	248	AR	3.55E-13	AR	0.97	800	AR	5.94E-07	AR	0.3	248	AR	3.55E-13	AR
Magnesium as Mg	70000	690	569250	R	3.43E+01	R	16	13200	AR	1.98E-12	AR	320	264000	R	2.63E+00	R	5.3	4373	AR	0.00E+00	AR
Potassium as K	200000	920	759000	R	2.91E+00	R	30	24750	AR	1.11E-14	AR	930	767250	R	3.06E+00	R	24	19800	AR	0.00E+00	AR
Sodium as Na	100000	1500	1237500	R	6.62E+01	R	NA	0.00	AR	0.00E+00	AR	1300	1072500	R	5.54E+01	R	NA	0.00	AR	0.00E+00	AR
Sulphate as SO_4	200000	550	453750	R	1.87E-01	R	< 1.0	0.00	AR	0.00E+00	AR	400	330000	R	2.15E-02	R	1.0	825	AR	0.00E+00	AR
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R		R			R		R			R		R			R		R

Table 112

EVAPORATION DAM 2: ENVIRONMENTAL RISK QUANTIFICATION • SEDIMENTS • SAMPLE NO. 18 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL – MASTER PLAN]

SAMPLE NO.: 18		RISK TO ENVIRONMENT									
		RISK OF SEDIMENTS FOR GROUNDWATER									
		SAMPLE NO. 16 VOLUME = 1,250,000 kg/ha/m									
		TOTAL ANALYSIS			[4]PROBIT MODEL		TCLP EXTRACTION			[4]PROBIT MODEL		
INORGANIC COMPOUNDS Micro's and Macro's	Acc. Risk Value (MR&SA) ppb	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	[1]Lab Conc ppm	[2]EEC ppb	[3]Risk R / AR	Risk Quantification%	[3]Risk R / AR	NOTES
Aluminium as Al	10000	6600	5445000	R	1.00E+02	R	0.09	74.3	AR	0.00E+00	AR	VOLUME = 1,250,000 kg/ha/m
Arsenic as As	430	< 50	0.00	AR	0.00E+00	AR	< 0.34	0.00	AR	0.00E+00	AR	
Barium as Ba	5300	6.4	5280	AR	7.66E-06	AR	0.44	363	AR	0.00E+00	AR	
Cadmium as Cd	1	< 10	0.00	AR	0.00E+00	AR	< 0.03	0.00	AR	0.00E+00	AR	
Chromium^{3+} as Cr^{3+}	4700	41	33825	R	2.60E+01	R	< 0.04	0.00	AR	0.00E+00	AR	
Cobalt as Co	6000	< 10	0.00	AR	0.00E+00	AR	< 0.12	0.00	AR	0.00E+00	AR	
Copper as Cu	100	< 10	0.00	AR	0.00E+00	AR	< 0.02	0.00	AR	0.00E+00	AR	
Iron as Fe	9000	14000	11550000	R	1.00E+02	R	83	68475	R	2.97E+01	R	
Lead as Pb	100	< 100	0.00	AR	0.00E+00	AR	< 0.31	0.00	AR	0.00E+00	AR	
Manganese as Mn	1	150	123750	R	1.00E+02	R	12	9900	R	9.90E+01	R	
Mercury as Hg	22	0.00	0.00	AR	0.00E+00	AR	< 0.01	0.00	AR	0.00E+00	AR	
Nickel as Ni	1140	< 10	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	
Selenium as Se	2	0.00	0.00	AR	0.00E+00	AR	< 0.05	0.00	AR	0.00E+00	AR	
Titanium as Ti	231	440	363000	R	1.00E+02	R	< 0.02	0.00	AR	0.00E+00	AR	
Vanadium as V	1300	12	9900	R	2.97E+01	R	< 0.07	0.00	AR	0.00E+00	AR	
Zinc as Zn	700	18	14850	R	9.29E+01	R	< 0.17	0.00	AR	0.00E+00	AR	
Calcium as Ca	3500000	4800	3960000	R	9.71E+01	R	270	222750	R	9.69E-03	R	
Chloride as Cl	250000	200	165000	AR	5.88E-06	AR	20	16500	AR	0.00E+00	AR	
Fluoride as F	1500	0.71	586	AR	1.69E-08	AR	0.6	495	AR	2.23E-09	AR	
Magnesium as Mg	70000	1600	1320000	R	8.92E+01	R	26	21450	AR	9.04E-10	AR	
Potassium as K	230000	1300	1072500	R	1.12E+01	R	42	34650	AR	6.66E-13	AR	
Sodium as Na	100000	1500	1237500	R	6.62E+01	R	NA	0.0	AR	0.00E+00	AR	
Sulphate as SO_4	200000	500	412500	R	1.02E-01	R	< 1.0	0.00	AR	0.00E+00	AR	
RISK / ACCEPTABLE RISK TO: ENVIRONMENT		R		R		R			R		R	

TABLES 113 -115

EVAPORATION DAM 2: SEDIMENTS INORGANIC
HUMAN RISK ASSESSMENT

Table 113

EVAPORATION DAM 2: HUMAN RISK ASSESSMENT • SEDIMENTS • SAMPLE NO. 16 [INORGANIC - MICRO'S & MACRO'S]
[ISCOR VANDERBIJLPARK STEEL - MASTER PLAN]

SAMPLE NUMBER: 16

INORGANIC COMPOUNDS Micro's and Macro's	[6] RfD/ ADI /GV mg/kg/day	[7] EPA RfD/ EPA DWEL/ RSA RfD/ WHO GV	RISK TO HUMAN							
			TOTAL ANALYSIS				TCLP EXTRACTION			
			[8] Lab conc. in Dam water ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %	[8] Lab conc. in Dam water ppm	[13] Conc. in groundwater (EEC) ppb	[14] PDI groundwater exposure mg/kg/day	[10] Margin of Safety %
Aluminium as Al	0.005	RSA RfD	5300	4372500	146	2915000	0.15	124	0.004	82.7
Arsenic as As	0.0003	EPA RfD	< 50	0.00	0.00	0.00	< 0.34	0.00	0.00	0.00
Barium as Ba	0.07	EPA RfD	5.9	4868	0.162	232	0.39	322	0.011	16.3
Cadmium as Cd	0.0005	EPA RfD	< 10	0.00	0.00	0.00	< 0.03	0.00	0.00	0.00
Chromium^{3+} as Cr^{3+}	1.5	EPA RfD	51	42075	1.40	93.3	< 0.04	0.00	0.00	0.00
Cobalt as Co	0.004	RSA RfD	< 10	0.00	0.00	0.00	< 0.12	0.00	0.00	0.00
Copper as Cu	0.04	EPA RfD	< 10	0.00	0.00	0.00	< 0.02	0.00	0.00	0.00
Iron as Fe	0.003	RSA RfD	5200	4290000	143	4766667	37	30525	1.02	33917
Lead as Pb	0.002	RSA RfD	< 100	0.00	0.00	0.00	< 0.31	0.00	0.00	0.00
Manganese as Mn	0.046	EPA RfD	120	99000	3.30	7174	3.2	2640	0.088	191
Mercury as Hg	0.0003	EPA RfD	NA	0.00	0.00	0.00	< 0.01	0.00	0.00	0.00
Nickel as Ni	0.02	EPA RfD	11	9075	0.303	1513	< 0.05	0.00	0.00	0.00
Selenium as Se	0.005	EPA RfD	NA	0.00	0.00	0.00	< 0.05	0.00	0.00	0.00
Titanium as Ti	0.003	RSA RfD	550	453750	15.1	504167	< 0.02	0.00	0.00	0.00
Vanadium as V	0.009	EPA RfD	15	12375	0.413	4583	< 0.07	0.00	0.00	0.00
Zinc as Zn	0.3	EPA RfD	30	24750	0.825	275	< 0.17	0.00	0.00	0.00
Calcium as Ca	5.0	RSA RfD	2500	2062500	68.8	1375	200	165000	5.50	110
Chloride as Cl	3.3	RSA RfD	100	82500	2.75	83.3	50	41250	1.38	41.8
Fluoride as F	0.06	EPA RfD	2.0	1650	0.055	91.7	0.3	248	0.008	13.8
Magnesium as Mg	2.3	RSA RfD	690	569250	19.0	825	16	13200	0.440	19.1
Potassium as K	6.7	RSA RfD	920	759000	25.3	378	30	24750	0.825	12.3
Sodium as Na	3.3	RSA RfD	1500	1237500	41.3	1250	NA	0.00	0.00	0.00
Sulphate as SO_4	6.7	RSA RfD	550	453750	15.1	226	< 1.0	0.00	0.00	0.00
RISK / ACCEPTABLE RISK TO: HUMAN				Groundwater	R			Groundwater	R	