EVALUATION OF MEASUREMENT UNCERTAINTY (MU)

SGS INDUSTRIES & ENVIROMENT, ENVIRONMENTAL TESTING: ALEXANDRA LABORATORY, NSW

Evaluation of measurement uncertainty (MU) was calculated at the 95% confidence interval, coverage factor k = 2 using batch control sample results. The following MU values are derived from as mentioned batch control samples ranging from 10 to 100 times the limit of reporting (LOR). As analyte results decrease and approach the LOR, estimated MU will increase. At concentrations

< 5xLOR, MU will be reported as the LOR concentration. i/s indicates insufficient data for MU Evaluation.

Microbiological measurement uncertainty (MU) is evaluated by analysis of cleint unknowns and PT samples by a minimum of two analysts and calculated from the standard deviation of the reproducibility of the final results which is then used to evaluate the uncertainty associated with the method.

			Water	Water	Soil	Air	Material
Method Num	Method Description	Test/Analyte	Relative MU % unless stated otherwise.	Relative MU % unless stated otherwise.	Relative MU % unless stated otherwise.	Relative MU % unless stated otherwise.	Relative MU % unless stated otherwise
AN065	**Lead in Paint (Extraction/AN320)**	Lead					7.7
AN101, AN006, AN007	**pH (soil, sludge, sediment, water, TCLP, ASLP)**	pH	0.2 pH units		0.2 pH units		
AN106	**Conductivity and TDS by Calculation**	Conductivity	7.3		5.4		
AN113	**Total Dissolved Solids**	TDS	23.1				
AN114	**Total Suspended Solids**	TSS	12.3				
AN119	**Turbidity**	Turbidity	4.3				
AN122	**Exchangeable cations and CEC by Sum**	Na			14.8		
		K			17.0		
		Ca			19.4		
		Mg			19.6		
AN124	**Hardness**	Ca/Mg Hardness	10.7				
AN135	**Alkalinity in Aqueous Solution**	Total Alkalinity	19.3				
AN140	**Acidity**	Acidity	18.6				
AN141	**Fluoride (ion selective)**	Fluoride	11.3				
AN142	**Fluoride in Soils**	Fluoride			40.4		
AN149	**Sulfide (iodometric)**	Sulfide, S^{2-}	44.5				
AN179	**COD - closed reflux, titrimetric**	COD	18.7				
AN183	**Biochemical Oxygen Demand**	BOD	22.4				
AN185	**Oil and Grease and hydrocarbons - Water - Gravimetric**	Oil & Grease	22.4				
AN186	**Oil and Grease - Soil Sludge Sediment - Gravimetric**	Oil & Grease					
AN188	**TOC in Soil by Titration**	Total Organic Carbon			16.4		
AN190	**TOC by NDIR**	Non Purgeable Organic Carbon	14.7				
AN192	**MBAS**	MBAS	20.5				
AN201	**Hexavalent Chromium (Cr6+) colourimetric**	Hexavalent Chromium			23.4		
AN226	**Formaldehyde**	Formaldehyde	21.0				
AN245	**IC anions**	Bromide	7.6				
		Chloride	9.1		11.0		
		Sulfate	9.0		12.4		
		Thiosulfate	12.3				
		Nitrate	7.8		10.3		

		Fluoride	12.5				
AN270	**Silica by DA**	Reactive Silica	10.0				
AN271	**Ferrous Iron by DA**	Ferrous Iron	10.2				
AN272	**COD by DA**	Chemical Oxygen Demand					
AN277	**Nitrite by DA**	Nitrite	11.6		14.0		
AN278	**Reactive Phosphorus by DA**	Reactive Phosphorus	11.8				
AN283	**Hexavalent Cr(6+) by DA**	Hexavalent Chromium	11.1				
AN285	**Colour by DA**	True Colour	7.3				
AN286	**Iodide by DA**	Iodide	17.5				
AN287	**Total and Free CN by DA**	See below for each cyanide form					
AN076	**Free Cyanide Distillation**	Free CN	15.7				
AN077	**Total Cyanide Distillation**	Total CN	19.6		20.5		
AN289	**Phenols Colourimetric by DA**	Total Phenols	12.4		12.9		
AN291	**Ammonia by DA**	Ammonia - N	9.4		9.8		
AN292	**Total Kjeldahl Nitrogen by DA**	TKN	11.0		10.1		
AN293	**Total Phosphorus by DA**	Total Phosphorus	10.2		13.0		
AN311	**Metals Cold Vapour - Water - Mercury**	Mercury	20.8	13.9			
AN312	**Metals Cold Vapour - Soils - Mercury**	Mercury			22.1		
AN318	**ICP MS**	**ICP MS**	**Soluble**	**Total**			
		Aluminium	10.9	15.3			
		Antimony	15.7	19.8			
		Arsenic	11.4	12.2			
		Barium	13.3	13.3			
		Beryllium	14.3	15.5			
		Bismuth		34.9			
		Boron	21.1	23.5			
		Cadmium	7.5	8.9			
		Chromium	6.5	7.9			
		Cobalt	13.1	13.4			
		Copper	8.5	10.0			
		Iron	11.0	14.7			
		Lead	10.4	8.0			
		Manganese	10.2	9.4			
		Molybdenum	8.3	11.3			
		Nickel	8.7	9.7			
		Selenium	13.2	11.4			
		Silver	29.3	26.9			
		Strontium	14.2	14.3			
		Thallium	12.4	13.6			
		Tin	14.3				

		Titanium	10.4	13.6			
		Vanadium	13.2	13.9			
		Zinc	10.1	11.4			
AN320	**Elements ICP OES**	**Elements ICP OES**	**Soluble**	**Total**			
		Aluminium	12.5		17.7		
		Antimony	15.5		25.6		
		Arsenic	7.8	12.1	13.2		
		Barium	7.0	8.2	24.4		
		Beryllium	5.7		11.8		
		Boron	12.0	11.7	24.5		
		Cadmium	15.2		43.4		
		Calcium	7.8	10.4	8.9		
		Chromium	7.4	8.1	13.3		
		Cobalt	7.1		9.9		
		Copper	6.7	11.3	15.5		
		Iron	12.3	11.5			
		Lead	9.2	8.6	10.1		
		Lithium	10.9	10.8			
		Magnesium	7.3	11.2	10.1		
		Manganese	8.9	7.3	15.1		
		Molybdenum	7.4		8.9		
		Nickel	9.7		8.8		
		Phosphorus	7.0				
		Potassium	10.3	11.5	17.8		
		Selenium	10.0		11.3		
		Silicon	17.4	18.1			
		Silver	9.2		19.3		
		Sodium	7.6	12.9	22.2		
		Strontium	5.8				
		Sulfur	8.8	7.6	9.5		
		Tin	8.6		10.1		
		Thallium	7.9				
		Titanium	7.3				
		Vanadium	7.3				
		Zinc	8.3	11.5	9.7		
AN403	**TRH**	**TRH**					
		>C10-C16 F2	30.0		31.2		
		>C16-C34 F3	31.9		20.0		
		>C34-C40 F4	35.0		36.6		
		>C10-C40 F	56.1		52.1		
		C10-C14	45.7		32.3		
		C15-C28	29.0		29.9		

		C29-C36	32.2		35.5		
		C10-C36	63.0		56.5		
AN420	**SVOC**	**SVOC**					
		OC Pesticides: Aldrin	44.1		44.9		
		Delta BHC	36.8		49.0		
		Dieldrin	31.1		45.8		
		Endrin	32.1		40.2		
		Heptachlor	35.6		53.9		
		p-p-DDT	38.0		45.8		
		Hexachlorobenzene	26.3		27.1		
		Hexachlorobutadiene	17.6		15.0		
		Hexachloroethane	15.0		22.2		
		Pentachlorobenzene	20.6		27.8		
		Pentachloronitrobenzene	42.6		46.1		
		OP Pesticides Chlorpyriphos	27.4		32.5		
		Diazinon	25.2		39.6		
		Dichlorvos	37.5		56.4		
		Ethion	33.2		56.4		
		d-14 terphenyl (surrogate)	48.8		16.1		
		PAH: Acenaphthene	43.0		17.8		
		Acenaphthylene	27.9		24.1		
		Anthracene	42.1		20.1		
		Benzo-a Pyrene	37.5		24.1		
		Fluoranthene	36.7		23.8		
		Naphthalene	41.0		25.5		
		Phenanthrene	44.9		22.3		
		Pyrene	37.4		17.8		
		Phenols: 2,4,6-Trichlorophenol	33.2		48.2		
		2,4-Dichlorophenol	40.4		53.0		
		Pentachlorophenol	58.3		53.5		
		Phenol	32.8		46.1		
		PCBs: Arochlor 1260	38.6		28.8		
		Phthalates: di-n-butyl phthalate	39.6		27.0		
		diethyl phthalate	32.7		29.8		
		dimethyl phthalate	34.9		27.7		
		dioctyl phthalate	44.1		33.5		
		Bis(2-ethylhexyl)phthalate)	39.0		26.1		
		Butyl benzyl phthalate	58.5				
		Other:					
		1,2,3,4-Tetrachlorobenzene	19.4		20.0		

		N-nitroso-di-n-propylamine	42.2		39.6		
AN433	**VOC C6-9 GCMS P&T**	**VOC**					
		VOCs: Benzene	25.5		24.7		
		Ethyl Benzene	25.6		22.0		
		m,p-xylene	32.0		23.0		
		o-xylene	27.7		18.9		
		toluene	28.8		24.0		
		BTEX	62.7		50.6		
		C6-C10	32.0		29.8		
		C6-C10 minus BTEX F1	47.9		42.5		
		C6-C9	33.1		32.1		
		1,1-Dichloroethene	36.8		49.3		
		1,2-Dichloroethane	32.8		16.0		
		Chlorobenzene	28.0		19.7		
		Chloroform	35.7		21.2		
		Trichloroethene	32.6		24.6		
		D4-1,2-Dichloroethane -Surr	24.2		19.7		
AN447	**PCB in Oil GCECD**	**PCBs** Arochlor 1260					38.6
AN449	**Passivated Cannisters, GC-MS**	Trichloroethylene				20.7	
		m_p_xylene				32.2	
		Freon -113				28.6	
		Dichlorodifluoromethane				29.8	
		Chloroform				24.0	
		1,3-butadiene				21.1	
		1,2,4-Trimethylbenze				22.9	
		1,1,2-Trichloroethane				22.1	
AN459	**Methane, Ethane, Ethylene, Propane, Butane, in Water**	Methane	18.0				
AN461	**VOC Charcoal-Hexane GCMS**	VOCs as Hexane				29.3	
AN467	**VOC in Charcoal-CS2 GCMS**	**VOC**					
		1,2-dichloroethane				25.8	
		1,4-dioxane				25.0	
		2-butanone (MEK)				22.5	
		Acetone				37.3	

		Acrylonitrile				41.7	
		Benzene				27.9	
		Carbon tetrachloride				25.8	
		Chlorobenzene				27.8	
		Cyclohexane				27.7	
		Epichlorohydrin				23.8	
		Ethyl benzene				30.0	
		Hexane				27.6	
		m & p-Xylene				32.6	
		o-Xylene				28.9	
		Styrene				21.4	
		Toluene				27.8	
		Trichloroethene				26.4	
		MIBK				25.8	
AN480	**C1-C6 in Air, GC-FID**	Methane				8.0	
		Ethane				12.9	
		Propane				10.2	
		Butane				6.2	
		Pentane				11.1	
		Hexane				17.1	
AN502/503	**Dust Deposition (solids)**	Soluble Solids	17.3				
		Insoluble solids	13.4				