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from the IRMA Standard v2.0 DRAFT 2.**

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## CHAPTER ANNEXES

**ANNEX 4.3-A: IRMA Water Quality Criteria by End-Use Tables****1) Criteria Protective of All IRMA Uses**

	Units	Protective of All IRMA Uses		
		FRESHWATER	MARINE	
		IRMA Surface Water <sup>1</sup>	IRMA Ground Water <sup>2</sup>	IRMA Marine Water
<b>METALS / METALLOIDS</b>				
Aluminum	ug/L	55	100	10
Antimony	ug/L	6	6	-
Arsenic	ug/L	10	10	8
Barium	ug/L	300	300	700
Beryllium	ug/L	4	4	-
Boron	ug/L	500	500	750
Cadmium	ug/L	1.8 *	5	0.12
Calcium	mg/L	measure	-	-
Chromium (Total)	ug/L	50	50	-
Chromium (III)	ug/L	4.9	4.9	27
Chromium (VI)	ug/L	1	8	1.5
Cobalt	ug/L	50	50	1
Copper	ug/L	2.4 *	200	1.3
Iron	ug/L	300	300	2
Lead	ug/L	2.5 *	10	4.4
Lithium	ug/L	2500	2500	-
Magnesium	mg/L	measure	-	-
Manganese	ug/L	50	50	10
Mercury	ug/L	0.06	1	0.016
Molybdenum	ug/L	10	10	-
Nickel	ug/L	20	20	5
Potassium	mg/L	measure	-	-
Radium 226/228	pCi/L	13.5	13.5	-
Selenium	ug/L	1	20	10
Silver	ug/L	0.25	100	0.7
Sodium	mg/L	measure	-	-
Thallium	ug/L	0.8	2	-
Uranium	ug/L	10	10	-
Vanadium	ug/L	100	100	100
Zinc	ug/L	13 *	2000	5

\* Use USEPA Hardness-based or Biotic Ligand Model (BLM) calculations for metals. (Values displayed assume 100 mg/L hardness for temporary reference only)

Notes:

<sup>1</sup> IRMA Fresh Water includes all freshwater uses except Freshwater Aquaculture, which is not a common use around mines. If Freshwater Aquaculture is a use downgradient of a mine discharge, then those criteria apply.

<sup>2</sup> IRMA Ground Water includes Uses for Drinking Water & Human Health, and Agriculture/Irrigation.

	Units	Protective of All IRMA Uses		
		FRESHWATER	MARINE	
		IRMA All Fresh Water <sup>1</sup>	IRMA Ground Water <sup>2</sup>	IRMA Marine Water
<b>OTHER CONSTITUENTS</b>				
Alkalinity (as CaCO <sub>3</sub> )	mg/L	350	350	-
Ammonia (NH <sub>3</sub> as N)	mg/L	0.01	0.02	0.02
Chlorine (as Cl <sub>2</sub> )	ug/L	0.1	0.1	0.5
Chloride	mg/L	113	113	120
Cyanide (Free or WAD)	ug/L	5	100	1
Dissolved Organic Carbon	mg/L	measure	-	-
Dissolved Oxygen	mg/L	5	-	-
Fecal Coliform / E Coli	MPN / 100mL	0	0	-
Fluoride	mg/L	1	1	1.16
Hardness	mg/L	500	-	-
Hydrogen Sulfide (as S <sup>2-</sup> )	ug/L	0.05	0.05	2
Nitrate & Nitrite (as N)	mg/L	10	10	-
Nitrate (NO <sub>3</sub> as N)	mg/L	2.3	10	4
Nitrite (NO <sub>2</sub> as N)	mg/L	0.06	1	0.03
pH	s.u.	6.5 - 8.4	6.5 - 8.4	7.0 - 8.5
Phosphorus	mg/L	0.025	0.025	0.062
Sulfate	mg/L	250	250	-
Temperature	degC	Δ < 3	-	Δ < 3
Total Dissolved Solids	mg/L	450	450	-
Total Suspended Solids	mg/L	15	50	10

Notes:

<sup>1</sup> IRMA Fresh Water includes all freshwater uses except Freshwater Aquaculture, which is not a common use around mines. If Freshwater Aquaculture is a use downgradient of a mine discharge, then those criteria apply.

<sup>2</sup> IRMA Ground Water includes Uses for Drinking Water & Human Health, and Agriculture/Irrigation.

## 2) Criteria by Designated Water Use

	Units	FRESHWATER					FRESH WATER	MARINE	
		Aquatic Fresh Water	Drinking Water & Human Health	Agriculture & Irrigation	Recreational	Industrial	Freshwater Aquaculture <sup>1</sup>	Aquatic Salt Water	Marine Aquaculture
METALS / METALLOIDS									
Aluminum	ug/L	55	100	5000	-	-	30	-	10
Antimony	ug/L	9	6	-	6	-	-	-	-
Arsenic	ug/L	20	10	100	10	40	50	12.5	8
Barium	ug/L	-	2000	300	700	3000	-	700	-
Beryllium	ug/L	-	4	100	-	-	-	-	-
Boron	ug/L	750	2400	500	500	3000	750	-	750
Cadmium	ug/L	1.8 *	5	5	3	5	0.2	0.12	0.12
Calcium	mg/L	measure	-	-	-	-	-	-	-
Chromium (Total)	ug/L	-	50	100	50	-	-	-	-
Chromium (III)	ug/L	8.9	-	4.9	10	-	-	27	-
Chromium (VI)	ug/L	1	-	8	-	20	20	1.5	2
Cobalt	ug/L	-	-	50	-	-	-	1	-
Copper	ug/L	2.4 *	2000	200	200	50	1	1.3	3
Iron	ug/L	300	300	5000	300	7500	10	-	2
Lead	ug/L	2.5 *	10	50	10	30	2.5	4.4	8.1
Lithium	ug/L	-	-	2500	-	-	-	-	-
Magnesium	mg/L	measure	-	-	-	-	-	-	-
Manganese	ug/L	430	50	200	100	2000	10	-	10
Mercury	ug/L	0.06	1	2	1	1.8	0.77	0.1	0.016
Molybdenum	ug/L	73	50	10	-	-	-	-	-
Nickel	ug/L	52 *	20	200	20	74	52	7	5
Potassium	mg/L	measure	-	-	-	-	-	-	-
Radium 226/228	pCi/L	-	13.5	54	-	-	-	-	-
Selenium	ug/L	1	50	20	10	40	5	71	10
Silver	ug/L	0.25	100	-	50	-	3	1.4	0.7
Sodium	mg/L	measure	-	-	-	-	-	-	-
Thallium	ug/L	0.8	2	-	-	-	-	-	-
Uranium	ug/L	15	30	10	20	-	-	-	-
Vanadium	ug/L	-	-	100	100	-	100	100	100
Zinc	ug/L	13 *	3000	2000	2000	120	5	8	5

\* Use USEPA Hardness-based or Biotic Ligand Model (BLM) calculations for metals. (Values displayed assume 100 mg/L hardness for temporary reference only)

### Notes:

<sup>1</sup> IRMA Fresh Water includes all freshwater uses except Freshwater Aquaculture, which is not a common use around mines. If Freshwater Aquaculture is a use downgradient of a mine discharge, then those criteria apply.

<sup>2</sup> IRMA Ground Water includes Uses for Drinking Water & Human Health, and Agriculture/Irrigation.

	Units	FRESHWATER					FRESH WATER	MARINE	
		Aquatic Fresh Water	Drinking Water & Human Health	Agriculture & Irrigation	Recreational	Industrial	Freshwater Aquaculture <sup>1</sup>	Aquatic Salt Water	Marine Aquaculture
OTHER CONSTITUENTS									
Alkalinity (as CaCO <sub>3</sub> )	mg/L	measure	-	350	-	-	≥20	-	-
Ammonia (NH <sub>3</sub> as N)	mg/L	0.01	0.02	-	0.06	0.3	0.02	0.03	0.02
Chlorine (as Cl <sub>2</sub> )	ug/L	0.5	0.6	0.1	-	-	2	0.5	2
Chloride	mg/L	120	250	113	250	400	-	120	-
Cyanide (Free or WAD)	ug/L	5	200	100	8	200	5	1	1
Dissolved Organic Carbon	mg/L	measure	-	-	-	-	-	-	-
Dissolved Oxygen	mg/L	5	-	-	-	-	-	-	-
Fecal Coliform / E Coli	MPN / 100m L	-	0	-	-	-	-	-	-
Fluoride	mg/L	1	1.5	1	-	2	20	-	1.16
Hardness	mg/L	measure	-	-	500	-	-	-	-
Hydrogen Sulfide (as S <sub>2</sub> -)	ug/L	2	0.05	-	50	50	1	2	2
Nitrate & Nitrite (as N)	mg/L	measure	10	100	-	-	-	-	-
Nitrate (NO <sub>3</sub> as N)	mg/L	3	10	-	2.3	15	3	45	4
Nitrite (NO <sub>2</sub> as N)	mg/L	0.06	1	10	0.3	-	0.03	-	0.03
pH	s.u.	6.5 - 9.0	6.5 - 8.5	6.5 - 8.4	6.5 - 8.5	6.8 - 8.5	6.5 - 9.0	7.0 - 8.5	6.0 - 8.5
Phosphorus	mg/L	0.025	0.025	0.025	0.025	-	0.025	0.062	0.062
Sulfate	mg/L	-	250	1000	250	500	-	-	-
Temperature	degC	Δ < 3	-	-	-	Δ < 3	Δ < 3	Δ < 3	Δ < 3
Total Dissolved Solids	mg/L	-	500	450	1000	-	-	-	-
Total Suspended Solids	mg/L	15	-	50	30	70	40	15	10

Notes:

<sup>1</sup> IRMA Fresh Water includes all freshwater uses except Freshwater Aquaculture, which is not a common use around mines. If Freshwater Aquaculture is a use downgradient of a mine discharge, then those criteria apply.

<sup>2</sup> IRMA Ground Water includes Uses for Drinking Water & Human Health, and Agriculture/Irrigation.

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