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Water quality aspects from Spanish sites to support managed aquifer recharge (MAR) guidelines not based on maximum allowable concentration standards - *Aspetti sulla qualità dell'acqua in siti spagnoli di ricarica delle falde in condizioni controllate per valutare le linee guida a livello nazionale per evitare l'utilizzo delle concentrazioni massime ammissibili.*

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Supplementary file - *File supplementare*

Annex 2 - *Appendice 2*

Table 10: *Maximum allowable concentration for MAR source water in Italy, Spain, and the Netherlands legislation. All parameters are in mg/L unless otherwise noted.*

PARAMETERS	ITALY	SPAIN (Percolation)*	SPAIN (Injection)*	THE NETHERLANDS
Conductivity (µS/cm)	2500	-	-	-
Total nitrogen (N)	-	10	10	-
Total suspended solids (TSS)	-	35	10	-
Turbidity (NTU)	-	-	2	-
Sodium (Na)	-	-	-	120
Chloride (Cl^-)	250	-	-	200
Sulphate (SO_4^{2-})	250	-	-	150
Fluoride	1.5	-	-	1
Nitrate (NO_3^-)	50	25	10	5.6
Nitrite (NO_2^-)	0.5	-	-	-
Ammonia (NH_4^+)	0.5	-	-	2.5
Phosphates	-	-	-	0.4
Halogenated organic compounds (AOX)	-	-	-	0.03
Boron (B)	1	-	-	-
Cyanide (CN^-)	-	-	-	0.01
Free Cianide (CN)	0.05	-	-	-
E.coli (UFC/100 mL)	-	1000	0	-
Nematodes (egg/10 L)	-	-	1	-
Antimony (Sb)	0.005	-	-	-
Arsenic (As)	0.01	-	-	0.01
Barium (Ba)	-	-	-	0.2
Cadmium (Cd)	0.005	-	-	0.0004
Chromium total (Cr)	0.05	-	-	0.002
Chromium VI (Cr VI)	0.005	-	-	-
Cobalt (Co)	-	-	-	0.02
Copper (Cu)	-	-	-	0.015
Lead (Pb)	0.01	-	-	0.015
Mercury (Hg)	0.001	-	-	0.00005
Nickel (Ni)	0.02	-	-	0.015
Selenium (Se)	0.01	-	-	-
Vanadium (V)	0.05	-	-	-
Zinc (Zn)	-	-	-	0.065
Mineral oils	-	-	-	0.2

PARAMETERS	ITALY	SPAIN (Percolation)*	SPAIN (Injection)*	THE NETHERLANDS
Aldrin	0.03	-	-	0.00005
Alpha-HCH	-	-	-	0.00005
Anthracene	-	-	-	0.00002
Atrazine	-	-	-	0.0001
Azinphos-methyl	-	-	-	0.0001
Bentazon	-	-	-	0.0001
Benzene	0.001	-	-	-
Benzo (a) pyrene (PAHs)	0.00001	-	-	0.0001
Benzo (b) fluorantene	0.0001	-	-	-
Benzo (g,h,i) perilene	0.00001	-	-	-
Benzo (k) fluorantene	0.00005	-	-	-
Beta-esaclorocicloesano	0.0001	-	-	-
Bromodichlorometane	0.00017	-	-	-
Chlorobenzene (mono)	0.04	-	-	-
Chlorotoluron	-	-	-	0.0001
Crysen	-	-	-	0.00002
DDT (DDD,DDE)	0.0001	-	-	0.00005
Dibenzo-antracene	0.00001	-	-	-
Dibromoclorometane	0.00013	-	-	-
Dichlorobenzene 1,4	0.0005	-	-	-
Dichloroethane 1,2	0.003	-	-	-
Dichloroethylene Trans-1,2	0.06	-	-	-
Dichlorophenol	-	-	-	0.0005
Dichlorophenoxyacetic acid (2,4D)	-	-	-	0.0001
Dichloropropane 1,2	-	-	-	0.00005
Dichlorvos (DDVP)	-	-	-	0.0001
Dieldrin	0.03	-	-	0.00005
Dimethoate	-	-	-	0.0001
Dinitrophenol 2,4	-	-	-	0.0001
Dinoseb	-	-	-	0.0001
Endosulfan	-	-	-	0.00005
Endrin	-	-	-	0.00005
Esachlorobenzene	0.00001	-	-	-
Esaclorebutadiene	0.00015	-	-	-
Ethyl-Benzene	0.05	-	-	-
Fluoranthene	-	-	-	0.0001
HC Total	0.35	-	-	-
Heptachlor and heptachlor epoxide	-	-	-	0.00005
Heptachlor epoxide	-	-	-	0.00005
Hexachlorabutadiene (mg/L)	-	-	-	0.00005
Hexachlorobenzene	-	-	-	0.00005
Hexachlorocyclohexane (HCH)	-	-	-	0.00005

PARAMETERS	ITALY	SPAIN (Percolation)*	SPAIN (Injection)*	THE NETHERLANDS
Indeno (1,2,3, c-d) pirene	0.0001	-	-	-
Isoproturon	-	-	-	0.0001
Linuron	-	-	-	0.0001
Mecoprop (MCPP)	-	-	-	0.0001
Methyl 2 - chlorophenoxysacetic-4 acid (MCPA)	-	-	-	0.0001
Metolachlor	-	-	-	0.0001
Metoxuron	-	-	-	0.0001
Mevinphos	-	-	-	0.0001
Napthalene	-	-	-	0.0001
Nitrobenzene	0.0035	-	-	-
Organoalogenates (total)	0.01	-	-	-
Parathion	-	-	-	0.0001
Paraxileno	0.01	-	-	-
PCDD, PCDF	4E-09	-	-	-
Pentachlorobenzene	0.005	-	-	-
Pentachlorophenol	-	-	-	0.0001
Pesticides Active substances	0.0001	-	-	-
Pesticides- total	0.0005	-	-	-
Phenanthrene	-	-	-	0.00002
Plaguicides s.l.	-	-	-	0.5
Polychlorinated biphenyls (PCBs)	0.00001	-	-	-
Simazine	-	-	-	0.0001
Sum organochlorine pesticides	-	-	-	0.0001
Tetrachlorethylene	-	-	-	0.0005
Tetrachlorophenol	-	-	-	0.0001
Toluene	0.015	-	-	-
Trichlorobenzene 1,2,4	0.19	-	-	-
Trichloroethylene	0.0015	-	-	0.0005
Trichlorophenol	-	-	-	0.0001
Triclorometane	0.00015	-	-	-
Trihalomethanes (THMs)	-	-	-	0.002
Vinile Chloride	0.0005	-	-	-

*The Spanish Royal Decree 1620/2007, established the MAC (in Spanish VMA) in the I.A annex in form of table 5 (environmental uses). In the last column (other criteria), apart from VMAs, the regulation rules that Art. 257 to 259 of the RD 849/1986 (hydraulic public domain guideline) must be fulfilled regarding spill authorizations. Later, the Royal Decree 665/2023 (BOE, 2023) definitely dissociated managed aquifer recharge and spills.